Vol. 44 JULY, 1950 No. 1

NATIONAL FIRE PROTECTION ASSOCIATION

Quarterly

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NATIONAL FIRE PROTECTION ASSOCIATION
International

Introducing the CARDOX AIRPORT FIRE TRUCK Model MC-750

An Effective Answer to the Needs of Smaller Airports and Industrial Plants

The new CARDOX Airport Fire Truck — Model MC-750 — enables *smaller* airports to have the same type of fire protection used and proved at hundreds of military airports. It gives *larger* airports greater safety for such operations as fueling, motor warm-up, and spill fires. It is also excellent multiple-purpose protection for industrial plants . . . The primary extinguishing agent is 750 lbs. of low-pressure carbon dioxide. Water and/or foam, provide cooling and blanketing effect to supplement fast extinguishment of carbon dioxide. Used as a conventional pumper, the Model MC-750 provides up to 400 gpm. Write for further information.

SPECIFICATIONS

Extinguishing Mediums:

750 lbs. Low-Pressure (0° F.) Carbon Dioxide (Rechargeable from low-pressure storage or high-pressure cylinders).

200-250 gals. water in tank.

20-25 gals. air-foam concentrate in tank.

Discharge Apparatus:

Two 100-ft. carbon dioxide hose reels, 150 lbs. min. per nozzle.

Two 100-ft. water-foam lines with foam guns and fog nozzles.

Pump:

200 gpm at 200 psi

100 gpm at 400 psi

One 3-in. suction inlet; 2-1½ in. discharge outlets.

Auxiliary equipment and chassis as specified.

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CARDOX CORPORATION • BELL BUILDING, CHICAGO 1, ILL.

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National Fire Protection Association
INTERNATIONAL

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QUARTERLY

of the

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Acme

On May 19 an explosion occurred on the South Amboy, N. J., waterfront during transfer of 427 tons of mines and dynamite via lighters to the S.S. *Flying Clipper* at anchor in Raritan Bay. Movement of the last carload of mines was being completed when the blast occurred. Thirty-one men at work on the pier and lighters were killed and the pier and lighters demolished. The brunt of the explosion was received by freight sheds, coal dumpers, cranes, a chemical plant and an electric light plant in the immediate blast area. The main part of the town was relatively intact, although windows were broken in most buildings in the area ½ mile south and 2 miles east of the blast. Relatively little major structural damage, power failure at the time of the explosion, and prompt warning to residents to shut off gas probably accounted in large measure for the almost complete absence of ensuing fires. Coal barges at the pier ignited and on May 21, fire broke out in fifty 200-lb. drums of yellow phosphorus stored in the yard of the chemical plant. It is believed that explosion of one of several mines that landed among the drums ruptured one of them. Because of the danger of exploding mines, and a favorable wind that carried phosphoric acid fumes out over the water, the fire was allowed to burn itself out. Reports of investigations of the explosion have not as yet been released.

The Quarterly

Vol. 44 July, 1950 No. 1

Meetings of Board of Directors

Atlantic City, N. J., May 15, 1950

Present

John L. Wilds, President
A. H. S. Stead, Vice-President
Allen L. Cobb, Vice-President
Hovey T. Freeman, Secretary-Treasurer
Curtis W. Pierce, Past President
Richard E. Vernor, Past President and Acting Chairman

A. L. Brown
Hylton R. Brown
Loren S. Bush
T. S. Duke
J. E. Frederickson
John Kidde
R. D. MacDaniel
John Neale
H. E. Newell
Geo. J. Richardson
W. A. Ross
W. W. Sampson

Percy Bugbee, General Manager, Robert S. Moulton, Technical Secretary.

Business Transacted

1. The report of the Chairman of the Board of Directors was approved for presentation to the annual meeting.

2. Treasurer's report was approved for presentation to the annual meeting.

3. In response to a request from the Electrical Correlating Committee for instructions, this committee was advised to proceed with the development of an abridged form of the National Electrical Code for use principally in small communities.

4. Mr. Bugbee reported on the approval of the fire prevention publicity project by the Executive Committee of the Board of Directors of the Advertising Council, on the arrangements made to continue Mr. T. Alfred Fleming as Chairman of the N.F.P.A. Committee on Fire Prevention and Clean-up Campaign, and on the appointment of the Industrial Committee. This report was accepted with expressions of appreciation to Mr. Bugbee and the staff for successful consummation of projects authorized by the Board at its last meeting.

5. An N.F.P.A. Committee on Civil Fire Defense was authorized with power to the Chairman of the Board to appoint the personnel of the committee.

6. Mr. Moulton reported that contributions have been promised sufficient to assure the success of the N.F.P.A. field engineering project for flammable liquids in accordance with the authorization of the Board at its meeting in July 1949. At the suggestion of contributors to this project, it was voted to extend the scope to permit the engineer to deal also with the subject of gases, particularly liquefied petroleum gases. An administrative committee for this project was appointed as follows: C. H. Bunn, Jr., Chairman, Chief John Alderson, R. D. MacDaniel, H. E. Newell, and H. L. Miner, ex-officio as Chairman of the Committee on Flammable Liquids, with power to the Chairman of the Board to make additional appointments.

one of them. Because of the danger of exploding mines, and a favorable wind, the instructions were allowed to burn itself out. Reports of investigations of the explosion have not as yet been released.

7. The resignation of Curtis W. Pierce as Chairman of the Committee on Technical Committee Procedure was accepted with expressions of appreciation to Mr. Pierce for his efficient and conscientious service as Chairman of this committee since its organization. Mr. A. L. Brown was appointed Chairman of the committee for 1950-51 and the Chairman of the Board was authorized to make an additional appointment to fill the vacancy due to the resignation of Mr. Pierce.

8. The appointment of Mr. H. H. Watson as alternate to Frank Thornton, Jr., as a member of the Electrical Correlating Committee was approved, subject to its acceptability to the Chairman of the Electrical Section.

9. It was voted to recommend to the annual meeting that Past President David J. Price be elected an Honorary Life Member of the Association.

10. It was voted to hold the next meeting of the Board in Boston on Monday, July 17, at 10 A.M.

Boston, Mass., July 17, 1950

Present

Richard E. Vernor, Chairman
A. H. S. Stead, President
Allen L. Cobb, Vice-President
T. S. Duke, Vice-President
Hovey T. Freeman, Secretary-Treasurer
C. W. Pierce, Past President

A. H. Baum
A. L. Brown
Hylton R. Brown
Leonard C. Lund
R. D. MacDaniel
J. A. Neale
H. E. Newell
George J. Richardson
W. W. Sampson
R. C. Sogge

Percy Bugbee, General Manager; Robert S. Moulton, Technical Secretary; Horatio Bond, Chief Engineer; Charles S. Morgan, Assistant to the General Manager; W. Y. Kimball, J. K. McElroy, G. H. Tryon, III, C. I. Babcock, M. R. Freeman, Charles L. Smith; H. E. C. Rainey, Chairman, Committee on Membership; W. J. Baker, Representative, Special Committee on Fire Protection Engineering.

Business Transacted

1. In accordance with the vote of the annual meeting, the following officers were elected: President, A. H. S. Stead; Vice-President, Allen L. Cobb; Vice-President, T. Seddon Duke; Secretary-Treasurer, Hovey T. Freeman; Chairman, Board of Directors, Richard E. Vernor.

2. The Advisory Committee for 1950-1951 was appointed as follows: Richard E. Vernor, Chairman, Allen L. Cobb, T. Seddon Duke, Hovey T. Freeman, A. H. S. Stead.

3. R. D. MacDaniel and John A. Neale were elected to complete the personnel of the Nominating Committee for 1951.

4. General Manager Bugbee reported on plans for the 1951 annual meeting in Detroit, May 7-11 and was authorized to proceed accordingly.

Mr. Bugbee reported on the developments in connection with the tentative plans for the 1952 annual meeting and was authorized to proceed in accordance with suggestions.

5. The Program Committee for 1951 was appointed as follows: President, Chairman of the Board of Directors, General Manager, and Director J. E. Frederickson of Detroit.

6. Treasurer Freeman reported on the finances of the Association. His report was accepted. The investment policy of the Association and the possible desirability of investing a part of the Association's funds in common stocks was discussed without action.

7. The budget for 1950-1951 as submitted by the Finance Committee was approved.

8. Mr. Moulton reported on plans for regional meetings to be held in St. Paul, Minn., during the week of November 13 and in Dallas, Texas, during the week of November 27, reporting staff visits to the respective cities, the organization of spon-

soring committees under the Chairmanship of Leonard C. Lund in St. Paul and A. Sidney Briggs in Dallas. Mr. Lund expressed satisfaction in connection with the plans for the St. Paul meeting, and Mr. Sampson commended the efforts of the N.F.P.A. staff in connection with the 1949 regional meeting in Atlanta. Plans for the 1950 regional meetings were approved as presented and the staff authorized to proceed accordingly.

9. General Manager Bugbee reported on developments in connection with the proposed issuance of certificates of appreciation to members who have rendered distinguished service to the Association. After discussion it was voted to suggest to the General Manager that he submit to the Board the names of members deserving expressions of appreciation in official letter or other form. It was also voted to authorize the Chairman of the Board to appoint a committee to give further consideration to this matter and report to the Board at a later meeting. Chairman Vernor appointed Allen L. Cobb, Chairman, Hylton R. Brown and John A. Neale.

10. Mr. Bugbee reported on developments in connection with the Advertising Council project indicating successful accomplishment to date and prospects for effective general fire prevention publicity during the coming year with particular emphasis on home fire safety. This report was approved with an expression of appreciation for the progress reported to date.

Industrial Committee

11. Mr. A. L. Cobb, Chairman of the Industrial Committee, reported completion of the organization of that committee and the initial steps in the formulation of the program. The various suggestions by the committee were discussed. A suggestion from this committee that an Industrial Session be held at the annual meeting on the first day, simultaneous with the Fire Marshals' Section meeting, was referred to the Program Committee. A suggestion from this committee that N.F.P.A. stands should contain explanatory material indicating the purposes and general intent of the standards to facilitate their understanding and application was referred to the Committee on Technical Committee Procedure.

The personnel of the committee was confirmed (to be published in the 1950 Year Book).

The following scope statement for the committee was approved:

An advisory committee to promote fire protection activities in manufacturing industries and to consult with the Association on industrial fire problems.

Report of Special Committee on Fire Protection Engineering

12. Mr. Warren J. Baker, Representative of the Special Committee on Fire Protection Engineering, presented the following report:

The Special Committee on Fire Protection Engineering was instructed by the Board of Directors to consider the professional status of fire protection engineering, and to report on what action, if any, the Association should take to promote fire protection engineering as a profession. Recommendations were presented to the Board of Directors under date of January 20, 1949. These recommendations were referred back to the committee for further consideration and the committee was instructed to submit detailed proposals for association action to establish the qualifications of members in the field of fire protection engineering.

In line with its assigned duties the Special Committee on Fire Protection Engineering submits the following recommendations.

1. Because there is a decided need to improve the professional status of Fire Protection Engineering among the ranks of other professional engineers in America, the Board of Directors of the National Fire Protection Association should appoint a steering committee to organize a Society of Fire Protection Engineers within the N.F.P.A. Such a society to be self-sustaining and regulated by the Board of Directors of the N.F.P.A.

2. That the Board of Directors of the N.F.P.A. authorize the staff of the N.F.P.A. to provide office facilities for a full paid Secretary to be employed out of the Society of Fire Protection Engineers' treasury, and to assist him in distributing society news bulletins and other printed matter which he will prepare as deemed advisable.

3. That the Board of Directors consider a Society of Fire Protection Engineers Section for a business meeting of the society at its annual convention.

4. The following grades of membership should be established by the Society:

A. Member — qualied to perform any of the following:
   (1) To design, direct or develop engineering work.
   (2) To apply engineering principles to fire protection problems.
   (3) To conduct important research in the field of engineering. Must have completed eight years of active practice in engineering,* three of them in responsible charge of engineering work. Must have attained the age of 35.

B. Associate Member — qualified to direct engineering work or apply principles of engineering in the field of Fire Protection. Five years active practice in engineering,* one of them in responsible charge of work. Minimum age 25.

C. Junior Member — shall be a student regularly enrolled in a school having a student branch of this society. He may retain this status until the age of 30 unless he has qualified as an associate member.

D. Honorary membership — may be conferred upon a member of acknowledged eminence in fire protection engineering or related sciences upon favorable report of the Qualifications Board and a majority vote of the society membership. This membership carries with it all of the privileges of full membership without dues.

*A graduate engineer from a school of accepted standing may be credited with four years of active practice.

5. The following membership dues and initiation fees are suggested:

	Initiation Fee	Annual Dues
Honorary Member	No	No
Member	$25.00	$10.00
Associate Member	15.00	5.00
Junior Member	No	2.00

With this action the Committee feels that it has discharged its responsibilities. All the members participated actively in the meetings which were held on a subject which presented many widely divergent viewpoints. The next move is up to the Board of Directors. The Committee is confident that the plan suggested will work. It must be very carefully launched as the way in which it is handled at the very outset will to a great degree determine the eventual success or failure of the movement. A founders' society for fire protection engineers is urgently needed. It is our fervent hope that the Board of Directors will take favorable action.

Respectfully submitted,
John J. Ahern, Chairman
Warren J. Baker
A. L. Cobb
John A. Neale
Elmer F. Reske
Carl G. Richmond
W. G. Schultz

After discussion, it was voted to approve this report in principle and to discharge the committee with appreciation for their services. It was voted to create a new committee with the same Chairman and personnel for the purpose of making the necessary arrangements to put the principles of the committee report into effect in cooperation with the N.F.P.A. staff.

Technical Committee Matters

13. The personnel of the Committee on Technical Committee Procedure for 1950-1951 was confirmed as follows: A. L. Brown, Chairman, Hylton R. Brown, Allen L. Cobb, H. E. Newell, R. C. Sogge.

14. The report of the Committee on Technical Committee Procedure, A. L. Brown, Chairman, was accepted (see also Minutes 15 and 16). On recommendation of the Committee on Technical Committee Procedure it was voted to change the definition of the word "approved" to read as follows:

"Approved" refers to approval by the authority having jurisdiction,

and to notify technical committees of the change in this official definition for use in N.F.P.A. standards.

15a. In response to requests for instructions from the Electrical Correlating Committee, it was voted on recommendation of the Committee on Technical Committee Procedure to advise the Electrical Correlating Committee as follows:

The scope of the National Electrical Code makes no restriction as to the source of electrical energy covered and it is therefore within the proper scope of the National Electrical Code Committee to consider dry cell batteries or any other source of electrical energy for any purpose within the general scope of the Code. It is for the committee to decide whether dry

cell batteries furnish a sufficiently reliable source of energy to be recognized by the Code and to include appropriate provisions in the Code on inspection, testing and maintenance if considered essential to assure reliability, or otherwise treat this subject.

15b. In response to a request of the Electrical Correlating Committee for revision in the Rules of Procedure for handling revisions of the National Electrical Code (previously approved by the Board), it was voted to approve the proposal with certain changes, the revised text of Section 4 of the Rules of Procedure to read as follows:

Electrical Section discusses and returns it to the Correlating Committee with its comments, for further consideration by the appropriate Panel if necessary.

16. It was voted to confirm technical committee appointments in accordance with the list submitted with the Agenda and supplementary appointments and recommended by the Committee on Technical Committee Procedure, and to authorize the Committee on Technical Committee Procedure to make further appointments prior to the publication of the 1950 Year Book subject to confirmation by the Board at its next meeting. It was further voted to reappoint for the committee year 1950-1951 all members of technical committees not otherwise mentioned except where members have resigned, have been replaced or have been inactive (complete lists of technical committee personnel will be published in the 1950 Year Book).

Spray Painting

17a. In accordance with the authorization of the annual meeting, it was voted to adopt the following amendments to the Standards for Spray Finishing Using Flammable Materials, No. 33 (N.F.P.A. Advance Reports, 1950) on unanimous recommendation of the Committee on Finishing Processes.

1. Revise Section 401 as follows:

401. There shall be no open flame or spark producing equipment in any spraying area as herein defined, nor within 20 feet thereof, unless separated by a partition, except as specifically permitted in the Standards for Class A Ovens and Furnaces (No. 86) Section No. 2033.

2. Revise Section 904 as follows:

904. High voltage leads to electrodes shall be effectively and permanently supported on suitable insulators, and shall be effectively guarded against accidental contact or grounding.

An automatic means shall be provided for grounding and discharging any accumulated residual charge on the electrode assembly or the secondary circuit of the high voltage transformer when the transformer primary is disconnected from the source of supply.

3. Revise Section 905 as follows:

905. A space shall be maintained between goods being painted or deteared and electrodes or conductors of at least twice the sparking distance. A suitable sign stating the sparking distance shall be conspicuously posted near the assembly.

Ovens and Furnaces

17b. In accordance with the authorization of the annual meeting it was voted to adopt the following revision of the Standards on Class A Ovens and Furnaces, No. 86 (N.F.P.A. Advance Reports, 1950) on unanimous recommendations of the Committee on Ovens and Furnaces.

3131 OTHER STANDARDS APPLICABLE

Gas piping and valves for natural and manufactured gases should be installed in accordance with the following paragraphs. Where high pressure services are utilized, the installation requirements shall comply specifically to the following paragraphs and to the applicable provisions of the A.S.A. Code for Pressure Piping B31.1 and revisions thereof. For requirements on Liquefied Petroleum Gas Installations see Section 3113 (b).

3132 PIPE MATERIAL

(a) Gas piping shall be so constructed and installed as to be durable, substantial, and gas tight. Either screwed, flanged or welded joints may be used. Unions where needed shall have metal to metal seats.

(b) The pipe and fittings used shall be of good material, clear and free from burrs and defects in structure or threading. Cast iron pipe and fittings shall not be used.

(c) Wrought-iron or wrought-steel pipe shall comply with the American Standard for Wrought-Iron and Wrought-Steel pipe, A.S.A. B36.10—1939 and revisions thereof.

(d) Pipe and fitting threads shall comply with the American Standard for Pipe Threads, A.S.A. B2.1—1945.

(e) Semi-rigid tubing and fittings where used, with approval of the authority having jurisdiction, for small main and pilot burner asesmblies, shall comply with the American Standard Listing Requirements for Semi-Rigid Gas Appliance Tubing and Fittings, Z21.24—1941 and revisions thereof.

(f) Brazed or soldered joints using solder having melting point over 1000°F. may be used for small tubing with the approval of the authority having jurisdiction.

3133 SIZE OF PIPING

Piping shall be of a size and so installed as to provide a supply of gas sufficient to meet the maximum demand without undue loss of pressure between the points of delivery and use.

3134 INSTALLATION OF PIPING

(a) Gas Piping shall be well supported and guarded against mechanical injury and, properly pitched to permit draining of any condensate.

(b) Piping should be supported by round wrought-iron or steel U-type or approved adjustable hangers at proper intervals.

(c) Flat Iron may be used for hangers or parts of hangers provided that the thickness of the metal is not less than 3/16 inch and that the hanger or part is of sufficient width to assure metal at the screw holes of approximately equal area to that required for round wrought-iron or steel U-type hangers.

(d) C-type hangers are acceptable for use on steel beams when provided with a strap. Where the steel beam is tilted so that the clamp cannot fall off, the strap may be omitted.

(e) Where piping is supported from masonry walls, through anchor bolts shall preferably be used, except in certain cases for small pipe size, metal expansion shields may be acceptable. Approved pipe hangers shall be securely fastened to the anchor bolts or expansion shields.

(f) All branch outlet pipes shall be taken from the top or side of running lines and not from the bottom.

(g) A tee fitting with the bottom outlet provided with nipple and cap instead of an ell fitting should be used at the bottom of all risers and drops.

(h) A drip in which condensate may collect and be removed, shall be provided at any point in the line of pipe where condensate would collect. Drip drain valves shall be closed with a valve provided with nipple and cap to prevent accidental opening. Drips shall not be located where the condensate is likely to freeze unless adequate provisions are made to prevent freezing. Suitable provisions should be made to protect persons or property from hazard while draining the drips or when disposing of condensate from the drips.

(i) Underground pipes should not pass through or below foundation walls into unfrequented spaces below buildings. Pipes for buildings having such spaces should rise above grade before passing through building wall to indoors.

(j) Pipe should not run in inaccessible or concealed spaces in or under buildings, where its condition cannot be inspected and undetected leakage might cause dangerous accumulations of gas.

(k) Pipe which is outdoors, buried or otherwise exposed to moisture or corrosive conditions, should have an outside protective coating.

(l) Pipe joint compounds, suitable for the fluid handled, should be used sparingly and applied to male pipe threads only.

3135 TEST OF PIPING FOR TIGHTNESS

(a) Before any system of gas piping is put in service, it shall be cleaned and carefully tested to insure that it is gas tight. Air, inert gas, or fuel gas should be used and a test pressure of at least 1.5 times the normal working pressure, but in no case less than 3 psig., should be bottled up in the system for a 10-minute period without any drop in pressure.

(b) Defects in pipe shall not be repaired other than by welding or by replacing defective pipe. Defective fittings shall be replaced.

(c) No flame or fire in any form shall be used in attempting to locate a gas leak.

(d) In no case shall gas piping be filled with water or other liquids to locate or eliminate leaks. Under no circumstances shall oxygen be used for this purpose, since it may form an explosive mixture with any oil or fuel gas within the pipe. A soap and water solution may be applied to the pipe exterior to locate leaks.

(e) Before gas is turned on into a system of new gas piping, or after being shut off, the entire system shall be checked to make certain that there are no open fittings or ends and that all valves at outlets are closed.

3136 EMERGENCY MANUAL SHUT OFF VALVES

Manually operated shut off valves, operated separately from any automatic valve, shall be provided to permit turning off the fuel in emergency and shall be located so that fires, explosions, etc., at ovens and furnaces will not prevent access to these valves.

3137 MANUALLY OPERATED VALVES

For pressures below 5 pounds per square inch, plug cocks or globe valves may be used. Where pressures are in excess of 5 pounds per square inch, plug cocks, lubricated plug cocks or packless globe valves should be used. Packed globe valves may be used in well-ventilated areas. Gate valves should not be used. Valves should be suitable for type of fluid handled.

On high-pressure systems, it is often desirable to provide a vent pipe to outdoors between the burner valves and the main shut-off. After burners are extinguished, the main valve should be closed and the vent opened. This is best accomplished by using a combination of a 3-way cock with 2-way key and a straight way cock arranged as shown in Figure 3.

3138 POWER OPERATED VALVES

Shall be packless construction and arranged to close in event of failure of the power supply except vent valves which may be arranged to open in event of failure of the power supply. For further information in regard to power operated valves, see Chapter V.

3139 PRESSURE REGULATOR

Where a pressure regulator or governor is used as part of an oven heating system, including gas mixing blowers and gas mixing machines, the air space of the diaphragm or bellows housing shall be vented outdoors, or to a constant burning pilot or to a safe location unless construction does not require a vent. The vent is not required when the diaphragm discharges through a restricted orifice into space large enough so that escaping gas would not present a hazard. Also the vent is not required for regulators having the diaphragm space connected to discharge piping from mixers through a restricted orifice. The foregoing does not apply to zero governors.

Municipal Fire Apparatus

17c. In accordance with the authorization of the annual meeting it was voted to adopt the following change in the Specifications for Automobile Fire Apparatus, No. 19 (Advance Reports, 1950) on recommendation of the Committee on Fire Department Equipment:

Delete requirement for 28-foot straight ladder from Sections A-13, Q-12 and from the Appendix.

Water Tanks

17d. In accordance with the authorization of the annual meeting it was voted to adopt the following amendment of the Standards on the Construction and Installation of Water Tanks for Private Fire Protection Service, No. 22 (Advance Reports, 1950) on recommendation of the Committee on Tanks:

3506 (j). A field test shall be applied to all gas-fired tank heaters to determine if the heater is so installed and adjusted that it is capable of burning its full rated hourly input of gas. The contractor installing the heater, if necessary with the assistance of a representative from the local Gas Company, shall measure the cubic feet per hour of gas input by meter, or by equivalent means, and so determine that the proper hourly Btu. input is being furnished, or make any necessary adjustments.

(All heaters approved by the American Gas Association have permanent marking showing the input ratings in Btu. per hour. The Btu. content of the gas can be obtained from the local Gas Company.)

Miscellaneous

17e. Chairman Newell of the Committee on Gases reported satisfactory progress in harmonizing differences of opinion concerning certain phases of the servicing of liquefied petroleum gas equipment for house trailers as referred back to the committee by action of the 1950 annual meeting with authority to report to the Board. Chairman Newell was authorized to submit the committee recommendations to the Board for letter ballot. The N.F.P.A. office was also authorized to submit to the Board for letter ballot the reports of any other committees previously authorized by the annual meeting to submit revisions of standards to the Board for approval in the name of the Association.

18. A proposal that the Committee on Hospital Operating Rooms sponsor an educational exhibit at the American College of Surgeons 1950 Annual Clinical Congress was approved, and the N.F.P.A. staff was authorized to proceed with the necessary arrangements in cooperation with the committee.

19. The membership status of lightning organizations was considered and the N.F.P.A. office was instructed to communicate the decision of the Board to the organizations concerned.

20. Mr. Bond reported on developments in civil defense.

21. A communication was presented from Past President Louis Wiederhold, Jr., expressing his thanks for a previous communication from the Board to him felicitating him on his many years of service as an officer and member of the N.F.P.A.

22. General Manager Bugbee reported on his recent trip to France and England, with particular reference to the high esteem in which the N.F.P.A. is held in those countries.

Institutional Fire Problems

By Joe R. Yockers, California State Fire Marshal

In all of the various types of occupancies, perhaps none presents more complex problems than the mental hospital or correctional institutions. In this occupancy group we find institutions for the treatment, care, and housing of the insane or mentally incompetent persons; correctional institutions for juvenile delinquents, and prisons for adult criminals.

The average citizen rarely ever visits one of these state institutions unless one of his immediate family is confined. When citizens, legislators, or public officials do visit these institutions, they are usually shown only the better portions. Such visitors rarely ever see the violent wards or the old dilapidated fire-trap buildings, and are, therefore, quite surprised when a fire official condemns them as fire-traps. Likewise, the press rarely ever has an opportunity to observe the over-all conditions in these institutions, and therefore it is always difficult for the fire official to obtain the cooperation necessary to gain the appropriation of funds to improve hazardous conditions.

Several factors complicate the problem of fire safety in state institutions:

The first is *restraint.* Persons are housed under restraint behind locked doors, barred windows, and often in straight jackets; and, according to recent newspaper reports, are sometimes chained to metal rings in concrete slabs.

Second, there is the problem of *nonambulatory patients.* In all of these occupancies, and particularly in the mental institution, there are non-ambulatory patients.

Third is the *overcrowded situation.* Institutions of this type are usually overcrowded, wards are so filled with beds that emergency evacuation is difficult, and it is not unusual to find the corridors filled with beds.

Fourth is the problem of *attendant personnel.* State institutions, like all state organizations, experience the difficulty of obtaining sufficient funds to employ adequate and competent attendant personnel. It is not unusual to find one attendant supervising 100 mental patients during the night hours.

Fifth, there is the *pyromaniac.* Pyromaniacs and persons convicted of crimes of fire are usually sent either to a mental hospital or a correctional institution where they may attempt to continue their practices.

And, sixth, are fire problems relating to *occupational therapy.* In addition to the problems mentioned above, one will find jute mills, furniture manufacturing, spray painting, wicker furniture manufacturing, and a number of other hazardous processes employed in the institution occupational therapy work.

In studying the institution fire safety problem, all of these factors and many more must be given consideration.

California Survey

It is my belief that California had, in 1943, about as desperate a situation in her state institutions as any state in the Union. We have approached this problem slowly but surely. In 1943 we undertook a complete survey of all State institutional facilities. It began in the State

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This paper, under the title "The Fire Problem of State Institutions," was presented by Mr. Yockers at the N.F.P.A. Annual Meeting in May 1950. Mr. Yockers was appointed State Fire Marshal in 1943.

Women's Mental Hospital, Stockton, constructed in 1868. Four-story, brick, wood joist construction. Stairwells and elevator shafts open from ground floor to attic. At time of condemnation in 1943 the building housed 1,365 patients, over 50 per cent of 350 women on fourth floor non-ambulatory. Building demolished following condemnation.

mental hospital group which at that time consisted of nine institutions housing 28,262 mental patients. During the ten or fifteen years preceding 1943, very little had been done in the way of adding new facilities to take care of the increasing patient load or to replace existing antiquated buildings, many of which were known to be dangerous fire-traps. The survey disclosed an overcrowding of 15.3 per cent which required that beds be placed close together in all wards and, in many instances, even corridors were filled with beds.

Survey Results

As a result of this survey, 47 mental hospital buildings housing 3,961 patients were condemned by the State Fire Marshal as being dangerous fire-traps, and 9 others were classified as unsafe, which by alteration or structural repair could be made reasonably safe. Three of the 47 buildings condemned were 4 stories in height, with brick exterior walls and wood interior construction. Interior stairways, elevator and dumb-waiter shafts were of the open, unprotected type, and extended from the ground floor to the attic. Their connection to corridor-ways formed a direct path for the rapid spread of fire through the entire building. A fire occurring on one of the lower floors would have quickly involved all of the stairs, corridors and exit ways, making it impossible to evacuate the patients in event of fire.

Time will not permit me to go into detail in explaining the innumerable structural deficiencies observed, such as open, unprotected attic areas with ventilating ducts terminating on the underside of the roof; combustible interior finish; temporary wiring with overloaded circuits, and security bars on windows, im-

bedded into the brick walls. If an architect had set about to design a model firetrap, we doubt that our conditions could have been bettered.

Action

Immediately after the condemnation report was filed, Governor Earl Warren called a conference of State officials, including the heads of departments having responsibility for construction, maintenance and operation of these facilities. Accompanied by Governor Warren this Committee made a special investigation of several of the larger condemned buildings to determine the exact conditions and to set in motion a program for alleviating the problems.

One of the buildings surveyed by this group was the women's building at the Stockton State Institution constructed about 1868. This building was designed for a bed capacity of 850 patients and at the time of the inspection there were 1,365 women housed under restraint within the 4-story brick and wood joist building. On the 4th floor of this building there were approximately 350 aged women, over 50 per cent of whom were nonambulatory, and there were 4 locked doors between them and the ground below. The open stairways connecting with corridors were such that should a fire have occurred on the floors below, the entire building would have been quickly involved by fire, and it would have been impossible to evacuate or rescue the patients on the

Hardware on inside grills padlocked on the inside at Napa and Stockton mental hospitals. Forcible entry from outside very difficult. These buildings being replaced with new fire-resistive construction.

Overcrowded ward in Haven Cottage at Sonoma State Mental Hospital. In addition to overcrowded wards, corridors in many instances were lined with beds.

Termination of ventilation ducts in attic space of Napa Mental Hospital, condemned for this and other hazards.

Mental Hospital, Napa, constructed in 1876. It housed 1,500 patients in 1943. Being demolished following condemnation. Four-story brick, wood joist construction, open stairwells and elevator shafts.

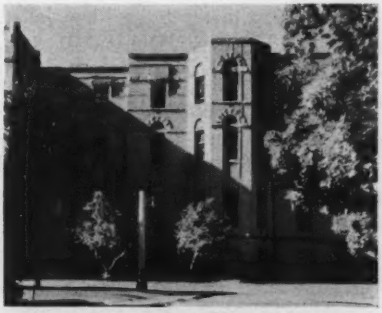
upper floors. There was a total of 26 attendants in this building at night, or about one attendant to each 52 patients.

Similar conditions were noted in the Main Hospital Building at Napa, built in 1876, which was of identical construction and height, but of a much greater area, housing approximately 1,500 patients in 1943.

It should be borne in mind that at the time of this survey the Nation was involved in a world conflict, building materials were needed for the war effort, competent architects and structural engineers were difficult to secure, machinery and equipment were under War Production Board controls. The population of the State of California was growing by leaps and bounds, putting a further load upon the already overcrowded hospital facilities.

Immediately following the Governor's conference, steps were taken to relieve, so far as was possible, the dangerous condition in these hospital facilities. Temporary stairway enclosures and fire separations were installed, temporary one-story wood ward buildings were constructed to remove the patients from the fourth floors of the more dangerous buildings, and a fire department organization was established in each of the hospital facilities. These departments consisted of a full-time Fire Marshal, a few full-time firemen, and a number of volunteer firemen selected and trained from among the institution employees. Emergency first-aid fire-fighting apparatus was provided and a continuous training program inaugurated.

Realizing that the neglect of our State mental hospital facilities had created a desperate condition, Governor Warren immediately inaugurated a program for reconstructing dangerous buildings and providing for additional bed space to take care of the overcrowded condition. This program has progressed as rapidly as the conditions previously mentioned have permitted. Between January 1, 1943, and January 1, 1950, $98,201,687 has been appropriated to replace dangerous buildings and revamp existing buildings to relieve overcrowded conditions in our State mental hospitals. This appropria-



Mental Hospital for Criminally Insane, Mendocino. Women patients housed under maximum restraint. New building to replace this four-story brick, wood joist structure.

Bed-filled corridor in Men's Building, Stockton Mental Hospital, following fire in 1935 which destroyed the story above. Evacuation of patients is difficult, if not impossible, under such conditions.

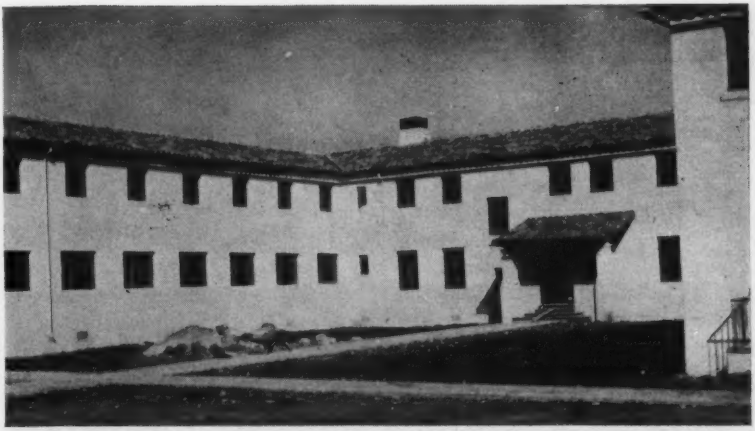
tion will replace all of the 3,961 beds in condemned buildings and will provide 14,639 beds to relieve overcrowding and to take care of the increasing patient load.

In addition to the 98 million dollars appropriated for mental hospitals $10,410,600 has been appropriated to correct deficiencies and modernize our juvenile correctional institutions, and $33,541,000 has been appropriated for alterations and additions to our adult correctional institutions. The total funds appropriated for all institutional improvement are thus $142,153,567.

New Construction

The new mental hospital buildings being constructed in California are all of Type I (reinforced concrete) construction. For the most part, they are one-story, and none of the new buildings are more than two stories in height. Considerable thought and study has gone into the planning of these buildings from a standpoint of economical operation. The wards, for example, are so arranged that during the night one attendant can watch over four separate wards from one centrally located attendant station in which light control switches and emergency telephone are provided.

As of January 1, 1950, 35 of the 47 buildings condemned by the State Fire Marshal have either been replaced, are under construction, or contracts have been let. In the construction of these 35 new



New fire-resistive (reinforced concrete) hospital buildings are being constructed to replace 47 condemned brick, wood joist buildings. Most of the new buildings are one story in height, none exceed two stories.

buildings, space for 7,571 new beds is provided, of which 3,957 are replacements and 3,624 are additional beds to relieve overcrowded conditions. In addition to replacing the condemned buildings, additional hospital buildings have been constructed to provide beds for 2,381 patients, and two complete hospital facilities with automatic sprinkler protection were taken over from the Federal government following the War, which provided space for 5,762 additional beds.

While this program to date has materially reduced the dangerous conditions from a standpoint of fire, our State institutions are still seriously overcrowded, and some of the dangerous buildings are still in limited use. The patient load of 28,262 patients in 1943 has jumped to 37,182 as of January 1, 1950. The population increase in State mental hospitals during this 7-year period has been 31.5 per cent.

New plans have been developed, funds appropriated, and some contracts have been let for the construction of three additional, completely new institutions. One of these institutions will be near Porterville; one near Atascadero, and one near Corona del Mar; and together they will provide additional bed space for 4,500 patients.

Existing Buildings

The twelve buildings which were condemned but have not yet been replaced,

Typical ward serving kitchen in new hospital construction. Main kitchen facilities are in separate buildings detached from ward or hospital buildings.

A modern fire station at Camarillo State Hospital. Similar stations have been constructed or are being planned for 10 other mental hospitals.

are of the one-story wood frame type of construction. The type of occupancy in these buildings has been changed to non-restraint housing of ambulatory patients. They will eventually be replaced.

Alterations have been made and fire safety conditions materially improved in the nine structures which were not condemned but in which alterations and structural repairs were needed. Perhaps the most difficult problems concern existing buildings. There is no single solution. Perhaps automatic sprinklers provide the closest to a complete solution to the protection of existing buildings.

Institution Fire Safety Committees

Our program of fire safety has been materially improved by the creation of a Fire Safety Committee in each of our State institutions. The Committee includes the Medical Superintendent, the institution's Business Manager, the Chief Engineer, and two other institution employees selected by the Superintendent. The Committees meet quarterly and on special call by the Medical Superintendents. They continuously study and work with the State Fire Marshal in the solution of many problems such as:

1. The fire prevention recommendations made by the State Fire Marshal;
2. The development and maintenance of a well-planned emergency evacuation plan for each separate building;
3. The requests for additional or replacement equipment for the fire defense system; and
4. Where and how fire and life hazards in the institution can be reduced.

The Committees have been very helpful in promoting good fire safety conditions in our State mental institutions. They have laid careful plans for evacuating patients in the event of emergency and their interest in the fire safety program has stimulated the interest of the employees.

Institution Fire Departments

In 1943 we had very little fire protection facilities in any of our State institu-

tions. Since 1943 we have gradually built up our fire department organizations. At the present time, our fire department organization for the protection of State institutions, including prisons, juvenile detention homes, mental hospitals, and other State-owned facilities is as follows:

32 Fire Stations

53 Pieces of motorized fire apparatus having a pumping capacity ranging from 350 to 1,000 G.P.M. each.

12 Fire Marshals and Fire Chiefs (full time)

51 Full-time Firemen

174 Part-time Firemen (40 hrs. per month)

105 Part-time Firemen (10 hrs. per month)

Money has been appropriated for the construction of nine additional fire stations, and two new triple combination pumpers, one 750 G.P.M. and one 500 G.P.M. have been ordered.

Considering all the factors, our program has progressed rapidly, and if carried to completion California will have one of the most modern mental hospital facilities in the United States. In order to maintain this position strict attention will have to be given to the replacement, the improvement and the maintenance of the California fire protection program. Continuous planning will also be necessary to take care of the ever-increasing institutional population of the State.

Cape Breton Hospital Fire

The North Block at the Cape Breton County Hospital, near Sydney, Nova Scotia, was destroyed by fire on March 22, 1950. Loss is estimated at more than $250,000. The 175 mental patients in the building were safely evacuated due to the efficient supervision of an officer of the Sydney Fire Department. This fire has several lessons for hospital administrators. Chief among them is the peril to life safety inherent in a multistoried combustible hospital. Although no fatalities occurred at this fire, the fact should not be overlooked that the patients were for the most part ambulatory and were up and dressed, not usually the case in hospitals. Had the fire occurred during the night, or had the patients been bedridden or under restraint many lives might well have been lost. At the St. Anthony Hospital fire, Effingham, Ill., April 4, 1949, in which 74 died, patients were bedridden and the fire was discovered at 11:45 P.M.

This fire also indicates the inherent hazard of large undivided attics and of unsprinklered concealed wall and ceiling spaces in sprinklered combustible buildings.

Based upon reports submitted by the Fire Marshal of Nova Scotia and the Sydney Fire Department.

Construction

The north block was a two-story structure consisting of a center section and two wings. It was built in 1905 with additions to the wings made in 1924. The entire building was of combustible construction and subject to total destruction if fire started in the honeycomb of hollow wall and ceiling spaces. Exterior walls were wood shingle, and the roof asphalt shingle laid on wood. The interior was divided into dormitories and smaller rooms by

Royal Canadian Mounted Police

Ignition of wood lath and joists in contact with a substandard chimney caused fire that spread through concealed spaces into the undivided 300-ft.-long attic.

wood lath and plaster walls on wood studding and ceilings of like construction. Floors were soft wood and stairways were open. Metal ducts 16 in. by 6 in. installed between studding vented first floor rooms into the undivided 10,700 sq. ft. attic that extended over the whole building.

Fire Protection

Automatic sprinklers supplied through a six-inch main at pressure exceeding 100 psi protected all parts of the building except wall and ceiling spaces where installation of piping and heads was impractical. Operation of sprinklers sounded the hospital fire alarm system. Two-inch standpipes with 1½-inch hose and numerous first aid extinguishers completed the private protection. The Sydney Fire Department, 3½ miles away, was the nearest public protection.

The Fire

Unknown to anyone the kitchen chimney caught fire and heat ignited wood lath and joists in the hollow wall spaces around the chimney while breakfast was being prepared for the 92 men and 83 women patients. At 7:30 A.M. all went to breakfast in the basement with the exception of four male patients at work on the second floor. At 7:35 A.M. one of the latter discovered smoke coming from around a window casing in one of the wings and shouted the alarm to an attendant on the floor below. Buckets of water were obtained and holes knocked in the wall around the window but no flames were visible until an attendant ran to another part of the building from where he could see flames coming from the eaves above the window. The window was approximately 15 feet from the kitchen chimney. An attempt was made to throw buckets of water at the eaves but when this proved ineffective an attendant ran to the matron's room and shouted "Fire." She completed dressing and went to the scene of the fire. About this time the hospital fire alarm

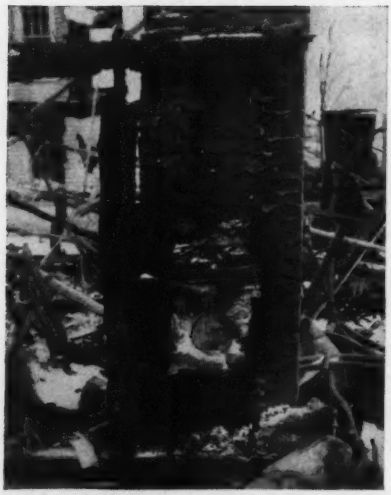
sounded, indicating that sprinkler heads were opening. It was then 7:50 A.M. At 7:55 A.M. the alarm was telephoned to the Sydney Fire Department.

A chemical hose wagon with five men was dispatched. It was apparent to the firemen as they approached the hospital that the chimney extending from the basement kitchen was on fire and on arrival flames could be seen above a second floor window 15 feet from the chimney. A second alarm at 8:10 A.M. brought a pumper and crew and a third alarm at 8:15 A.M. brought a ladder truck. At 8:50 A.M. a pumper and crew was sent from the Navy Base at Point Edward. Other arrivals included the Dominion Steel Company's fire brigade at 9:00 A.M., and the Marion Bridge Fire Department at 12:00 noon.

The first fireman on the scene took a hose up an outside fire escape to a second floor dormitory where large areas of ceiling plaster were falling from the weight of water from attic sprinklers. Fire by this time had spread vertically through wall spaces and had entered the attic. Wood lath was torn down revealing a roaring fire overhead that gradually spread to all parts of the undivided attic, opening sprinklers as it progressed. The more than 100 sprinklers that opened in this area overtaxed the estimated maximum 700 gpm flow through the sprinkler system, although in the words of Roy Hudenburg of the American Hospital Association, "A fire of this kind would conceivably have trapped the occupants of the building had it not been for the dogged protection of

Royal Canadian Mounted Police

Although operation of over 100 heads in the undivided attic depleted the water supply, sprinkler discharge is credited with retarding the fire sufficiently to permit safe evacuation of all occupants.



Chimney where fire started. A few of the defects noted in the investigation after the fire are visible.

the sprinkler system which held down the fierceness of the fire during the evacuation proceedings."

As soon as the seriousness of the fire was recognized the hose line was taken from the building and transfer of all patients via a tunnel to the south block twelve feet away was commenced. Captain Louis Smith of the Sydney Fire Department organized the operation quickly and efficiently. Under the direction of the matron some of the patients were carried on stretchers, and others were assisted to safety through the tunnel.

There was inadequate water for both hose streams and sprinklers during the early stages of fire fighting. Hose streams were improved to some extent when the sprinkler system was shut off, but it was not until a snow plow cleared a path to the Sydney River 900 feet away at 10:30 A.M. that all available hose streams, six 2½-inch lines and two 1½-inch lines, could be supplied. All streams were used to prevent spread to the seriously exposed south wing where the evacuees and the 155 regular occupants were confined. The south wing was saved and the fire in the north wing brought under control by noon.

Cause

An investigator of the Sydney Fire Department definitely placed the origin of the fire in the kitchen chimney. The chimney had been in continual heavy use for 45 years and contained several defects. Walls were 4 inches thick and unlined. The pipe opening was irregular in shape with openings around the pipe. The clean-out hole had been covered with wood lath and plaster faced with nailed wood and sheet metal. Soot plugged the chimney from the base to the bottom of the smoke pipe opening. Wood furring was nailed directly to the chimney from the basement to the attic and floor joists were in close contact. Which of these defects was actually responsible for the fire could not be determined, and is of little consequence. Any one of these deficiencies could have caused this destructive fire and it is evident that the north wing had been operating on borrowed time for several years because of these defects. It is folly to assume that the construction defects and poor chimney maintenance noted in this fire are peculiar to the Cape Breton County Hospital. Such dangerous weaknesses on hospital buildings must be detected and corrected by a continuous intelligent program of inspection.

The Oil Industry's Interest In Fire Safety

By Oliver W. Johnson
Fire Protection Engineer
Standard Oil Company of California

You probably understand fire safety in the same broad sense as I do, namely, both the prevention of fire and any steps which may be taken to limit the spread of fire either by construction or by fire fighting. In the 1950 Advance Reports of the NFPA the twenty subjects covered are about equally divided; half deal primarily with prevention of the start of fire and about half with control and extinguishment. About the same distribution of interest has been evident in the meetings of the American Petroleum Institute (API) Committees.

Everyone who reads this has an active interest in fire protection. The very fact that you are reading it is proof of that. Perhaps this interest arises from an inborn hate of the waste and the sorrow which is the usual result of fire. Perhaps it is the unconscious reaction to the challenge of a job which is difficult and which has continually expanding horizons presenting ever new problems.

The oil industry's interest in fire safety is expressed collectively in many ways which prove it is not lacking in enthusiasm. In my own company, it was twenty years ago that we conducted the first full-scale tests of foam for the extinguishment of oil tank fires, using a tank 95 feet in diameter. The results of these tests were published in the API proceedings. Significant facts developed during the course of those tests are still recognized and used in the current work of your committees. In our various regional fire protection groups in the oil industry, we frequently get together to discuss fires which have occurred to determine, if possible, the basic causes, and the best means of preventing future recurrences. When it seems necessary to run tests to settle some point, such tests are frequently arranged.

In the American Petroleum Institute we have an opportunity to contribute to the collective effort in the same way which you contribute by your efforts to this organization. Tangible evidence of our interest is given in the manuals on fire protection in refineries, on tank cleaning, on storage tank venting, and on numerous other items issued from the office of the API*. The object of these publications is to attempt to encourage practices which are sound and workable, universally applicable, and which will make a significant contribution to safety. We try, insofar as possible, to avoid useless precautions, or those based on superstition or whim, or simply because it has always been done that way.

I feel strongly that our energies must be constructively directed. We simply do not have the time to be chasing those things which are actually not hazards. The petroleum industry has, of course, taken its part in the activities of the NFPA, notably in our participation in the Flammable Liquids Committee and kindred activities.

This article is based on a talk presented at the 54th Annual Meeting of the Association at Atlantic City, N. J., on May 17, 1950.

*50 West 50th Street, New York, N. Y.

Ideals vs. Dollars

However much an individual may be personally interested in fire protection — and his approach may in some ways be somewhat idealistic — he may suffer a severe shock when he comes up against the problem of finance. Every fire chief knows that in getting approval for his budget, he must in some way or another demonstrate to his city officials, and possibly also to the public, that the cost of operating his department brings to the municipality a commensurate return in the form of decreased fire insurance premiums, lessened fire losses, greater peace of mind, and a decreased chance of injury or loss of life. Some of these factors are easily expressed in dollars. Others are largely intangible. It is a selling job. I know fire chiefs who have been outstandingly successful very largely because of their ability to educate the public to the value of some of these intangible factors. Every salesman of fire insurance knows that the customer must be convinced that in purchasing insurance he is going to get peace of mind and a sense of security against the possibility of a crippling loss, and that these things which he receives will much more than repay him for the premium.

Every fire protection engineer knows when he submits a recommendation for an expenditure, such as to cover some device or change in design calculated to reduce the risk of fire, that he ought to be able and prepared to show, if necessary, not only that the expenditure will accomplish all that he claims, and that the saving will in time repay the investment, but also that there is no simpler or cheaper way to accomplish the same end. Perhaps he doesn't have to prove this every time, but he should be able to if necessary.

This question of the economic justification of expenditures for fire protection appears to me to warrant a little more detailed consideration here. The problem is not easy, largely because of the difficulty of evaluating some of the intangible factors in terms of dollars and cents. The problem is something like that of the harassed parents of six lively children, who were heard to remark that they wouldn't take a million dollars for any one of them, but wouldn't give ten cents for another. People sometimes have great difficulty in evaluating intangible things.

Fire Insurance Rates and Safety

In the justification of an expenditure, a simple case arises where a single structure is under consideration and that structure is covered by insurance. If an expenditure to decrease fire risk will make enough savings in the insurance premium to repay the investment in a reasonable time, there should be no question about the investment. However, if the fire protection expenditure involves not only a capital outlay but also possibly an increased annual expenditure which exceeds the reduction in premium, such an investment might not be considered justified. Nevertheless, a consideration of the intangible benefits which might be associated with it may still make the investment seem attractive. Many large enterprises carry their own insurance. The reason is, of course, that with properties widely diversified, there is little chance of the single fire damaging more than a small part of the productive capacity. When a company is self-insured, the economic justification of investments for fire protection becomes more difficult to demonstrate — and the need becomes greater.

Fire Frequency Factors

The first step in any analysis is to consider the chance of fire under the existing conditions. Account should be taken of fires in similar installations elsewhere, together with the effect of any special features of the installation in question. Sometimes there is a lack of precedent. On the other hand, where there are a large number of similar installations, the problem may be quite simple. In one region in which our company operates we have a large number, about 400, old wooden oil derricks. Every once in a while lightning strikes one of these derricks and burns it down. It happens that this is not a particularly serious problem, because many of the derricks are being pulled down anyway. The point I want to make is that where a large number of similar structures are involved, fire frequency factor can be quite easily established — in this case one fire in five years for 400 units gives a frequency factor of 1 in 2000. And if we had similar derricks in some other area, and someone proposed, for instance, that we put lightning protection on them, that frequency factor of 1 in 2000 would be one of the things we would want to use in evaluating the justification for that expenditure. For other types of structures the factor may be higher or lower. For most types of commonly used tanks, of which we, of course, have thousands, the factor is less than 1 in 1000, and may well be on the order of .0001 (one in ten thousand) in many classes of service. Some estimate of the frequency factor must be made for the structure in question in every case.

Tangible and Intangible Fire Losses

The next step in our problem of analysis is to estimate what the direct monetary loss would be if a fire should occur. This estimate must take into account the replacement value of the structure, the chance that the fire might be controlled before it is completely destroyed, and the likelihood that the fire might spread to other structures. Many of these questions are little more than guesses, yet it is usually possible to make a rational overall figure by considering each of those factors separately.

The most trying problem is to attempt to evaluate the intangible losses associated with a fire. These may include loss of production, interruption of business, adverse public opinion, and similar factors which are very difficult to evaluate. Here again most of the figures are guesses. But experience has shown that it is better to break down the problem and make several guesses and combine them than it is to try to make a single guess to cover the whole question. Sometimes the intangible losses are arbitrarily made equal to the estimated monetary loss. Sometimes if public opinion is involved, they may be made greater than that. If there is any question, it is probably best to err on the high side, at least for a preliminary figure.

The total probable loss by fire is, of course, the sum of these two figures, the direct losses plus the intangible losses. The figure we have been struggling for in this somewhat laborious fashion is the probable annual loss, which is simply the product of multiplying this total loss by the fire frequency factor.

All of this so far has dealt with the conditions as they now exist. The next problem is to repeat the process, making appropriate adjustments where necessary, to take account of the effect of the proposed expenditure for fire prevention or fire fighting facilities. In the end we have two figures, and one deducted from the other

is the annual saving, and that, compared with the cost of the proposed investment, will give us at least a rough clue as to whether the expenditure looks like a desirable investment.

Now, all this sounds like a very cumbersome method of arriving at what sometimes appears at the outset to be a very simple answer. After an honest attempt to evaluate all of these factors I have discussed, we may end up by making a decision on the basis of general policy, or possibly some extraneous circumstances deemed significant in the particular situation. Nevertheless, I feel strongly that the procedure is sound and in most cases warranted. The very act of breaking the problem down into smaller problems tends to improve the accuracy of the final decision. Frequently, in the course of analyzing the problem, some alternate method of accomplishing the desired end may suggest itself. I am sure that in a simplified form most of you employ these same principles in deciding whether many expenditures are justified. There is no organization, corporation or municipality that can be successful unless its funds are expended wisely. In the long run we have neither enough money nor enough time or energy to spend them in any but the most profitable ways.

Arriving at Fire Frequency Factor

The key figure in all the preceding discussion was this figure called the fire frequency factor. This factor, of course, can never be exactly established, but neither should it be a blind guess. I think that all petroleum industry fire protection engineers agree that no one of us can ever become an expert solely as a result of his own personal experience. We simply do not have enough fires to fight, enough investigations to make, or time to make them, to personally encounter more than a few of the almost infinitely large number of possible circumstances. Hence we must all lean heavily on each other to fill out and complete the picture of our knowledge. One of the most important things to be gained from NFPA meetings is the opportunity it gives each of us to meet and talk with many other people, to learn their points of view and hear of their experiences.

There is one important published source of information on the fire losses in the petroleum industry which is published by the American Petroleum Institute, and has been for the past sixteen years.* In 1948 data were submitted by 194 companies whose investment totaled nearly six billion dollars. The total fire loss during the year was four and a quarter million dollars, which figures to a loss ratio of about 7.2 cents per $100. Even allowing for the known and unavoidable divergence of the way in which those figures are prepared, I do feel that that is a very creditable showing. The figures are segregated by types of installations, and in some cases, where there are a large number of installations of approximately equal size and use, it is possible to derive fire frequency factors from these figures. For example, reports were received covering nearly 27,000 bulk marketing plants. Those plants, of course, vary in size. The average insured value was only $18,000, so you can see that there must have been many small plants included. The loss ratio for these plants was 10 cents per $100 valuation. The frequency of fire in

*"Fire Loss Report of 1948 completes 15-year record on Properties, Oil stocks and fires." American Petroleum Institute, Department of Safety, 50 West 50th Street, New York, New York (price: 5c).

any one plant was 210 years. Apparently most of these fires were small. The average annual fire loss expectancy per plant is only $18.00. I think it is obvious that for the average plant no great additional expenditure for fire protection would be warranted. Of course, all plants are not average, and the ones that are the worst in mechanical equipment or operating practices present the greatest possibility for successfully attacking that average and further reducing the loss.

NFPA Flammable Liquids Engineer

I have mentioned experience on several occasions — both personal and fire experience. Experience has been jokingly defined as something one learns while looking for something else. I know all of us have had that experience of stumbling onto a fact which was quite unrelated to the thing we were looking for. However, in the long run I do believe that experience must come from careful, intensive, and intelligent search. That is why the oil industry is cooperating in a substantial way in the proposal recently announced for employing an NFPA Flammable Liquids Engineer, who will, in part, serve as the Secretary of the Flammable Liquids Committee, but whose duty it will also be to attempt, by actual personal investigation, to dig out the important facts about certain types of fires in which petroleum products or flammable liquids play a part. We feel that in many cases the real lessons which might be learned from a fire are not learned simply because there is no one in the vicinity who is either inclined or who has the knowledge to permit an accurate investigation. Sometimes, of course, also, there is reticence to discuss freely all circumstances of a fire. Having the Flammable Liquids Engineer associated with the NFPA may in part assist in overcoming this latter difficulty. We hope that this program will be so successful that it will be continued indefinitely and that from it will come, in the long run, a significant contribution to our knowledge of how some of these more important fires start and spread, and what we can do about it.

To summarize, we feel that successful fire prevention depends on two things basically; first, knowing enough about conditions to recognize those points which present the greatest potential fire hazard, not only from the standpoint of frequency but also, and often more important, from the standpoint of the consequences; secondly, knowing the most practical, sure, safe and effective ways in which the chance of fire can be decreased, and concentrating on the things which will actually yield the biggest results.

Developments In Forest Fire Protection

By A. A. Brown, Chief
Division of Fire Research, U. S. Forest Service

Forest fire protection has a definite relationship to the over-all national fire problem and to the job of municipal and industrial protection. For the purpose of this discussion, forest fires include all fires on uncultivated lands in forest, brush, or grass cover. During 1948, the last year for which complete information is available, protection agencies reported a total of 174,000 such fires with a total area burned over of over 16½ million acres and a total tangible damage of over 32 million dollars. This includes estimates for large areas that have no organized protection.

For the half billion acres now under organized protection, the corresponding figures are 68,000 fires, 2,274,000 acres burned over, and a reported damage of $8,760,000. There were about 20,000 more fires reported in 1949 and higher costs and damages though complete figures are not yet available.

Probably the weakest part of these statistics is in the damage estimated, since so much of the public damage to resources is not easily evaluated in dollars. A good many billion dollars worth of forest values and other property of all kinds were threatened by these fires and it would be more useful if we could measure the success in terms of the damage actually prevented. In any case, it is a very important part of the total loss from fire in the U.S.A.

Some of the distinctive characteristics of the job of fighting such fires that make it different from the structural fire fighting job might be listed in about seven categories. The more important are:

(a) Wild land fires tend to have an unlimited threat. Much of the time we have to fight brush and grass fires because of their threat to valuable property that may be miles away rather than because of the damage they may be doing at the point of origin. The same principle applies in some degree to all fire fighting, but I think of it as a particular characteristic of good forest fire fighting strategy. Forest fires usually cover area quite rapidly and good strategy must be aimed at stopping the entire fire front. So forest fire fighting must be an all out offensive in each case. As soon as forces concentrate on defense instead of offense to save an individual piece of property (that happens to be in its path), the fire is likely to escape control.

(b) A second characteristic of wild fires burning in the open is that they are exposed to free circulation of air and respond freely to all the variations in weather conditions. For that reason their behavior depends *both* on fuel and on weather. So action has to be geared closely to weather conditions, and our forest fire fighters have to know a great deal about meteorology.

(c) A third characteristic is that organized forest fire fighting is necessarily more extensive in character. It does not have the benefit of short distances, paved streets, water hydrants, and other concentrated facilities. The job must be carried on under many limitations on speed of action and on materials and facilities that can be employed. This forces us to reduce protection to its simplest terms and to make skillful use of indirect methods.

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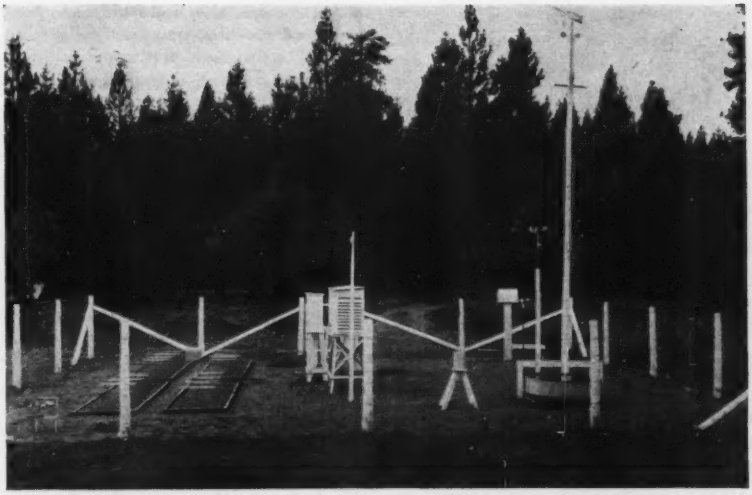

Fire-weather station at Pilgrim Creek Nursery at Shasta National Forest, California.

(d) A further special characteristic of forest fire control is in the training and organization required. Forest fire fighting crews and other manpower are fire fighters only for a part of the year. When on duty they have to be widely dispersed and cannot be controlled and disciplined on the pattern of a city department. This calls for more self-sufficiency of the individual and a somewhat different kind of training.

(e) A further characteristic is that mechanization of the job is much more difficult and calls for a greater diversity of equipment and methods.

(f) A further characteristic, which has probably done most of all to set the problem apart from industrial and municipal protection, is that it is differently financed. The protection given is largely to uninsured values at their source, where a large part of the justification for protection lies in the more or less intangible public values that may not be realized directly by the property owner. I refer to such things as watershed and recreation values that the public cannot afford to have depleted, but which the property owner might not be interested in protecting for his own purposes. So cooperative financing becomes essential.

The effect of these various characteristics has been to set forest fire protection somewhat apart from the similar work in the field of municipal and industrial activity. Similarly, it has so far been financed on a cooperative basis through federal, state, and private funds, and there has been relatively little investment in fire insurance to protect the marketable values that are threatened.

Before discussing the most recent developments in this field, I think it will be worth while to give a thumb nail sketch of the makeup of the progress of forest fire protection over the last 40 years. Organized protection of wild lands did not make much headway until after 1910 following the great conflagrations in north Idaho and other forest areas in the West. The Forest Service had been recently created and found itself charged with the responsibility for preventing or reducing such losses to our natural resources. Experiences of 1910 showed that nothing that had been done up to that time was ade-

quate to meet such situations. This started a process of investigation and systematic planning that has brought progressively better protection each year up to the present time.

At the same time the value of the property protected and its importance to our national economy have kept on increasing at a rapid pace, and dollar losses have not declined. This is good evidence that the problem is not solved and that the rate of increase in expenditures for fire protection and the rate of progress made have not been enough. One indication that there is no room for complacency is that the rate of loss is still too high to be attractive to insurance underwriters. Some valuations, which have recently been developed in a study made by the Forest Service, show that present national forest protection expenditures amount to an insurance rate of only about one-half per cent.

The high points in progress since 1910 might be summed up in the following six categories.

(a) **Time and Coverage Investigations.** Early in the development of systematic forest fire control our investigators studied the relation of success in forest fire fighting to the time elapsed from the start of the fire until it was attacked. These studies played an important part in developing fire control policies and in setting up standards for action. From them the old slogan of "getting the fire small," which all fire fighters in all fields recognize, was given emphasis. In addition, the time that could be allowed for the different acts that led up to control of a fire was given special attention and time standards for performance were set up.

(b) **Systematic Planning.** From these facts the concept of coverage of area was developed and was utilized in developing a systematic pattern for uniform protection of large areas of forest land. Coverage consisted of computing the area that could be seen from various arrangements of fixed fire lookouts and of computing the area that could be reached within prescribed time limits by fire fighters traveling on foot, on horseback, or by motor vehicle from existing or proposed time centers. These time coverage studies showed the weak spots and enabled the blueprinting of the most desirable placement of fire control facilities and manpower. From these two processes, systematic protection of wild land areas could develop on a sound basis.

(c) **Building Flexibility into the Fire Organization.** The variability of the forest fire problem is such that the fire fighting job to be done on a protected unit varies within wide limits not only from day to day but by seasons of the year and periodically over long periods of years. It is always too costly to maintain a forest fire-fighting system at a year-long level that would be adequate for all emergencies. To meet this problem a whole series of studies have been devoted to developing the necessary methods and guides to build up or reduce the organization as needed so that fire forces will be at the right strength to meet the threat at any given time. This is a long continuing process which has benefited a great deal from research. It is still far from complete but it offers the best opportunities for increasing efficiency. The effort has included such things as carefully identifying the fire season or the times of year when fires are to be expected in enough numbers or of sufficient threat to justify fully organized action. It involves too the identification of dangerous fuels and the particular areas which are most exposed to fires starting. The best single expression of this general effort was developed by research men and took the form of the fire danger meter in the early 1930's. It correlates the various weather elements and other factors which set the stage for dangerous forest fire conditions and classifies them into gradations of fire danger. Devices of this kind have been developed in every forest region and have been a very important factor in the organization of forest fire control forces to attain maximum protection at minimum cost.

(d) **Extension of Protection.** The extension of protection to a progressively increasing proportion of the wild lands that need it has of course been a very important part of the history of progress. Most federal and state forest lands are now under organized protection and

an increasing proportion of private lands has been placed under some form of systematic protection. The most important controlling factor has, of course, been the availability of funds to finance this work. Since the war, costs of operation have moved up much faster than increases in funds. This has limited the extension of protection and has forced a reduction of the effort in many problem areas.

(e) **Preventing Man-caused Fires.** This is a tremendous field in itself, including such things in the equipment field as spark arrestors on trucks and tractors, and such activities as the elimination of fire hazards in structures and sawmills and on logging and construction operations; the building of fire breaks; the clean up of debris in key areas; the enactment of legislation to control fire starting activities; the enforcement of fire laws; the elimination of motives for incendiarism; and most of all the education of people in fire consciousness and in what to do to keep fire from getting out of control.

The job resolves itself into general public appeals and specific measures on the ground.

(f) **Equipment Development.** The development of better equipment especially adapted to forest fire control work has been an important part of the progress of this work from the beginning. In more recent years such work has been devoted to mechanizing the job wherever feasible. Success in this endeavor still offers a great deal of promise for the future. Features of this work will be discussed later.

The progress of protection during the last five years is to be made the subject of a study by the American Forestry Association on which a report will be made during the next year. The more important of the special developments during this period are related particularly to the extension of protection, to the development of better equipment, and to improvement of the fire organization. These things are of particular significance in the progress of protection on state and private lands under conservation departments in each state.

Extension of Protection. One of the most important has been the growth of organized protection in the various states with extension to new areas that has amounted from 25% to 35% over that in 1945.

Fire guard placing basswood moisture content strips on scales at fire-weather station on Coal Knob lookout tower, Allegheny National Forest, Pennsylvania.

Development or Adaptation of New Equipment for Fire Fighting. Several important developments in equipment have improved fire fighting efficiency in recent years.

Improved communication has been a feature of the last five years. Many of the state organizations have become fully equipped with high frequency radio since the war and have established complete radio nets for the first time.

The Forest Service pioneered the development of portable radio equipment before it was available through commercial sources. Such equipment has gone through a great deal of evolution, but the equipment now adopted as standard by the Forest Service is of the high frequency FM type which has been found superior to the AM types formerly in general use.

Protection agencies have been converting over to FM high frequency equipment and the Forest Service is replacing many back-country telephone lines by highly efficient equipment of this kind. The effect of improved communication is to promote better organization, to make control of action more positive, and to speed up operations. The results are easy to recognize.

Improved equipment of this kind is of a

Supplies being dropped to fire fighters by parachute at Mazatzal fire in Tonto National Forest, Arizona.

dependability quite comparable to the networks in use by police and other closely knit organizations even though the distances of operation are of course greatly extended. These developments contribute particularly to the flexibility of the fire control organization which I have already mentioned.

Increased use of improved plows has greatly speeded up fire line building particularly in our southern region, where a light tractor-plow combination which can be hauled on a 1½ ton truck and placed on a fire quickly has become standard equipment. Improved plows of several categories have also come more into use in all of our eastern regions, both in the state organizations and on the national forests.

In recent years tractor dozers have come into increasing use to build fire lines in the heavy brush and slash cover in the Northwest and on the West Coast. Last year 35% of the fire line built by the Forest Service in fighting fires was by bulldozers. This amounted to a seasonal total of 280 miles of bulldozer fire line.

Tanker trucks have also become the standard for first attack in most areas where road accessibility is good. There has been a profusion of sizes and designs. Recently an effort is being made to standardize to a few types and the Forest Service is favoring the slip-on type of unit which can be readily removed from the truck chassis. Tank trucks were used on 2,382 fires or slightly over one-fifth of the fires fought by the Forest Service in 1949.

New 4-wheel drive equipment, which was greatly improved during the war period, is also contributing a great deal to fire fighting by improving access to fires off roads. In addition to facilitating scouting and general transportation, its special contribution is in increasing the range and usefulness of tanker equipment. This makes it possible to apply water to a much higher percentage of fires than formerly.

Light mechanized trencher equipment, which may help to fill the gap between bulldozers and hand tools, is in the process of development by the Forest Service, and two models are available for test. Both are new in concept over anything now in use but show much promise. It is hoped that one or both of these may come into use in the West in the next few years.

Use of Aircraft. I think most of you have heard of the parachute fire fighters that are used to fight forest fires in certain of our back-country areas in the West. Success in this method of delivering fire fighters to the scene of action was well demonstrated preceding and during the war. Since then it has become a routine

method for considerable areas. In the process, the use of airplanes has had a rather far reaching effect on the fire control facilities and manpower maintained on the ground. Where the dependence is now placed on smoke jumpers, the number of men maintained in the forest area during the fire season is greatly reduced. Similarly, where aerial patrol is now substituted for fixed lookouts, many of the fire lookouts are abandoned.

The potential value of helicopters was given special study in 1947, and subsequent experience in their use has well borne out the belief that they have possibilities of becoming a fine fire-fighting machine. Load limitations and ceilings still limit their use in much of our mountain country, but rapid development in the helicopter field promises to minimize these limitations in the near future. It has possibilities not only of providing shuttle service that is so valuable in an emergency situation but has possibilities as well of applying control measures directly to a fire to make it a flying fire wagon.

An effort to utilize fixed-wing aircraft for direct control measures was made in studies carried out in 1947 in cooperation with the Air Force. These were devoted to techniques of bombing fires from the air with extinguishing bombs. Unfortunately, the Air Force was unable to continue the project a second year, but a good many things were learned that will be of useful application in further studies in this field.

Altogether the possibilities of new progress by aerial methods are far from being exhausted and hold much promise for the future, particularly in the more inaccessible forest country.

Cloud Seeding. One further new possibility, which has not yet been explored very far, is that of preventing lightning fires through overseeding the local storm clouds that build up in some of our mountain areas during the dangerous fire season. We call them dry, lightning storms since they carry very little rain but produce a great deal of lightning that often starts great numbers of fires in a very short time. Such fires have of course always been considered unpreventable. But Drs. Langmuir and Schaefer, the famous scientists of General Electric, who have discovered supercooled vapor in the clouds and

Helicopter scouting Wheeler Spring fire in Bear Canyon at Los Padres National Forest in California, 1948.

ways of causing it to precipitate, have changed even this assumption. The charge of electricity is not generated until the cloud builds up above the freezing level. There is a chance to break up such local storms before they reach this stage by overseeding them, and there is a chance too that this will prove practical. We are also hopeful that the new work that has been going on in seeding clouds to cause precipitation may have value at times in forest fire fighting where even small changes in the humidity of the air and its temperature are often of great importance in the behavior of a forest fire.

New England Compact. A new development in the last two years has been the interstate compact developed by the New England states to facilitate joint action in fighting fires across state boundaries. This grew out of the experiences of the great fires in southern Maine during 1947. It recognizes the necessity of unified action in fire emergencies and is aimed at minimizing the effect of jurisdictional boundaries in taking effective action.

National Programs in Forest Fire Prevention. During and since the war, the nation-wide Cooperative Forest Fire Prevention Program has been an outstanding development in the progress of forest fire control. The forest visitor, including the hunter, the fisherman, and the vacationist, who just wants to enjoy the forest country, comes from every part of the U.S.A. and from every walk of life. They start forest fires unintentionally through ignorance or carelessness, and nothing short of a nation-wide campaign is effective.

I think all of you have been introduced to "Smokey Bear" and you have asked Clint Davis of the Forest Service, who is in charge of this program, to tell you about it. So it is unnecessary to give any further detail here. This program, conducted jointly by State and Federal Forest Services under sponsorship of The Advertising Council, is devoted to educating the general public. So it has to stick to the things that are more or less universal in application. To be most valuable the effort needs to be taken up locally where the national program leaves off.

Keep America Green. A further development of national scope and significance has been the organization of "Keep Green" committees by towns, counties, and states under the sponsorship of the American Forest Products Industries. Such programs have the advantages of stimulating local initiative and of directing attention to local situations. Such programs are active in 27 of the most heavily timbered states. They have the hearty cooperation of all protection agencies and have also contributed greatly to the education of the American people in why and how to prevent forest fires.

Miscellaneous. Fire danger ratings have been extended in use a great deal among the state organizations in recent years and several are in the process of further refinement. In the Northeast, a new application of danger ratings has proven useful. In that territory the number of fires that occur are closely proportional to the fire danger ratings. Consequently, the number of fires to be expected under the weather conditions that existed during the season can be computed. With this expected number as a basis of comparison, the success or lack of success of the fire prevention measures taken can be measured quite successfully. This application is proving to be a very useful new tool in measuring the effects of a fire prevention campaign, or of new legislation, or of closures of forest areas.

Other developments that are relatively new have been such things as going all the way in delivering hot food direct to the scene of a fire by parachute from a plane with the messing of men organized accordingly at a central point rather than placing dependence on former methods of establishing back-country fire camps, extending special uses of the helicopter in handling operations on a going fire, improved safety provisions, more use of chemicals in forest fire fighting, etc.

Fire Research

Early research in forest fire behavior and its relationships to successful control of outdoor fires provided the foundation on which much of our progress has been built. Unfortunately, work in forest fire research began to languish with the end of the CCC program and was almost entirely neglected throughout the war period.

Since then, at the urging of fire control field men, an effort is being made to regain some of the lost ground, and a new division that I represent was set up in the office of the Chief of the Forest Service a little over a year ago. This was made possible by a small increase in the funds available at that time. But we are attempting to give investigative service to a 50-million-dollar national project with a total of only ten men scattered throughout the U.S.A. Their accomplishments are excellent, but they can only nibble at the edges of the tremendous array of problems that need modern scientific answers. Every day, decisions have to be made that affect fire expenditures or the threat of fire loss without the benefit of a clear knowledge of the alternatives and often without due regard to some of the principles of insuring values.

The National Fire Protection Association may be more interested in increasing our knowledge of fire and our skill in dealing with it wherever it may occur than they might be in actual forest fire control operations. There is a community of interest here that needs more recognition. The threat of a conflagration, such as has occurred so many times in the past, ought to be the concern of everyone interested in the protection from fire. The experiences in southern Maine in 1947 provide proof if any is needed. Structural firemen may not give enough thought to the effects of wind and weather when they make their plans. It is too easy to become absorbed with the details and techniques of dealing with a fire inside a structure. As soon as a real disaster is in the making, you are faced with exactly the problem that the forest fire control expert must deal with. Unexpected fire behavior under such circumstances seems to be the rule. We have ambitious plans for improving the knowledge of the aerodynamics that operate under such conditions. It is one of a dozen similar difficult undertakings that call for the best talent the country can produce. If ways and means can be worked out for a pooling of effort in many of these over-all problems, it will advance the purposes for which this Association was created.

Protection Of Business Records

By A. J. Steiner

Chairman, NFPA Committee on Protection of Records

Records of certain kinds are of vital importance to every business. Their loss by fire may mean the discontinuance of a going business, even though physical property can be quickly replaced. Some years ago a survey showed that 43 per cent of business concerns whose records had been destroyed by fire did not resume business. The loss of important records may mean that fire insurance may not be collected, that contracts cannot be enforced, that designs for products which have taken years to develop are lost, and that engineering work must be duplicated at enormous cost. Records are not generally appraised or insured, and for this reason, their importance and value are commonly underestimated.

Most records may be shown to have a definite value in dollars, generally far greater than is commonly realized. Some records, historic objects and valuables are irreplaceable at any cost. In any case, values of the more important records are such that absolute protection is required — protection against the most severe fire conditions that may be anticipated, rather than protection against only ordinary fire contingencies, which may be adequate in the case of physical property that can be readily replaced. Inventories of business concerns often show record values several times the value of buildings and contents. Business records have in general been very inadequately protected, and their loss by fire has had serious consequences.

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The NFPA Committee on Protection of Records has made comprehensive studies of this problem. Their detailed recommendations have been printed in the NFPA publication, Protection of Records. Reference should be made to this publication for complete details of vault construction, classification of records and other features.

A Record Survey

The first step in any program of record protection is to make a careful survey of your records and to determine their relative importance. Records should be segregated into those which are absolutely essential, those which are important but would not cripple the business if lost, and those less essential records which have only temporary value. Protection should be planned for each class in accordance with its value. In the average office the expense of maximum protection for all records may be prohibitive, but by proper segregation the records of major importance will usually be found to have only relatively small bulk and can be protected at reasonable cost. Obsolete and useless records should be removed, as they not only complicate the filing problem but present so much additional fuel in case of fire. Details on classification are given in NFPA publication, Protection of Records.

Selection of Method

There are various satisfactory methods of protecting records. Each has a field of usefulness, depending upon the conditions in the individual business and the relative importance of the records. Standard methods of fire prevention and protec-

tion such as are good practice for any building will reduce the probability of any serious fire, but no prudent executive will place sole reliance for protection of his records upon ordinary means of fire prevention. He knows, for example, that no matter how many "no smoking" signs may be posted and how rigidly smoking rules may be enforced, it is always possible that a fire may be started by a surreptitious smoker. Again I refer you to NFPA Protection of Records which gives details on the method to select equipment.

Safes

The commonest method of record protection is the use of the insulated safes which are regularly available in 1-, 2- and 4-hour fire ratings and have a fine record in preserving their contents in case of fire. Modern safes shown by test to have their rated fire resistance are listed and labeled by Underwriters' Laboratories. Beware of safes made many years ago, which often look substantial and may possess some fire resistance, but their value cannot be told from their appearance, and many a fire has shown the folly of trusting valuable records to a safe of uncertain value. Modern safes are not only tested for fire resistance, but are designed to withstand the falls and impacts due to the collapse of buildings.

Vaults

Vaults are commonly used where large volumes of records are to be safeguarded. Vaults can be built for any desired degree of fire resistance. NFPA Protection of Records gives details. Substantial construction and the use of a special type of insulated vault door are necessary. Tested vault doors, like safes, are available in various ratings with Underwriters' Laboratories label. Many old vaults with uncertain walls and with uninsulated steel plate doors do not warrant the confidence that is placed in them.

Record Rooms

Many concerns having large volumes of records to protect construct record rooms built somewhat like vaults but with a lesser degree of protection. Such rooms are suitable where there is a large volume of records of moderate value.

Use of Equipment

Whatever type of record protection equipment is provided it will be of no value unless the records are in it and the doors are closed when a fire comes. It should be a rigid routine of every office that all valuable papers be kept in their designated containers at all times when not actually being worked upon. This may seem self-evident, but a surprising number of record losses have occurred because the protection provided was not used. Some offices have regular record drills to assure that in case of fire all valuable papers will be promptly returned to safes or vaults.

Sure Protection Needed for Records

I wish to repeat that the protection of vital business records should afford absolute safety under the most adverse fire conditions. Relative safety such as suffices for the building itself is not enough. In the protection of ordinary property you can weigh the cost of fire protection against the hazard, insurance premiums, etc., provide protection against ordinary fire conditions, and perhaps take some chance on the unusual or extreme conditions, knowing that you are safeguarded by insurance.

But this is not true of your records, for they will be most needed in case of the exceptional disastrous fire when the usual safeguards fail, as, for example, in the

case of conflagrations where the fire department is unable even to reach your building, when public water supplies are out of service due to some disaster, or when private fire protection facilities may fail. Record protection should be such that valuable papers will be saved even though conditions are such that no fire fighting efforts are possible.

Do not be lulled into a feeling of security by "fireproof" building construction, for even the best of buildings have combustible contents, flooring, furniture, partitions, etc., which make a severe interior fire possible, even though the structure of the building is intact. A stove may be "fireproof," but you can have a hot fire in it.

The Watchman Today

By Frank R. Middaugh

Chairman, NFPA Committee on Fire Brigades and Watchmen

Someone once said, "If you have an elderly employee whom you would like to relieve of some duties, but still do not want to pension, don't make him into a watchman, but make him vice-president — he will cause you less damage." This is not to infer that the watchman is more important in your plant than the vice-president, but let's think a minute.

On the average, say two-thirds of the time, the values represented in your plant are under the sole custody of watchmen personnel, acting under the direction of plant management. What are these values? The plant buildings, machinery, equipment and stocks of raw and finished materials. These are physically apparent values representing capital investment. Equally, or even more important are the potential productive capacity of the plant, the continuity of operations and continuing jobs for employees. When the plant is destroyed, everyone suffers from the top management down to the lowest floor sweeper.

Since in a matter of hours, or even minutes, a successful business which has been years in the making can be destroyed, during periods of shutdown as well as during operations, through the perils of fire, explosion or other hazards, it is of the utmost importance that men to whom these values are entrusted should be chosen not only for character, reliability, competency and judgment, but also that they be trained and physically able to act in an emergency.

Years ago, the watchman was not considered as a very important part of the organization of a plant. Too many times, the job was given to incompetent persons or persons not physically sound or mentally able to make the decisions which a good watchman should be able to make on the spur of the moment. Remember, there is no one with higher authority on hand to make his decisions for him. He must make them himself, and quickly. Today, the thinking has changed and the watchman is not pushed aside as a neces-

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sary evil to take care of an aging employee, who needs something to keep him busy or as a means to a credit in fire insurance rates, but he has come into his own and is being recognized for what he is — a valuable and trusted employee.

Selecting a Watchman

Too much stress cannot be placed on finding the right man. Each plant should draw up a set of qualifications and requirements to be used in selecting watchmen personnel. Here are a few which might be considered:

1. A very young or extremely aged man should not be employed. A very young man, ordinarily, has not acquired judgment and a sense of responsibility. An extremely aged man is not likely to be alert or to have the requisite physical strength and endurance.

2. He should be of medium height — about 5'-10" or 5'-11".

3. He should be of medium weight — about 160 to 170 pounds. Height and weight should be in relation to each other as short, fat men or tall, thin men usually do not "fill the bill" as well as men who are of good build.

4. The man must be in good physical condition. He does not need to be an athlete, but neither should he have a heart condition or other physical ailment which might work to his disadvantage in moments of stress.

5. The watchman should have a high school education or its equivalent.

6. He should be a citizen of the United States.

7. He should have no police record and should be of good character.

8. His maximum age for active service ordinarily should be not more than 60.

9. A new watchman should be placed on probation for a period of about six months, after which time he should be required to pass a written examination before he is given a final appointment.

There are two more important points which should not be overlooked or neglected:

1. The watchman should be given an annual physical examination. He might be perfectly sound and able when he is employed, but he might not remain so.

2. He should be given an annual written examination on pertinent facts and information. He should keep himself well informed and shouldn't be allowed to deteriorate into just a clock puncher.

Don't forget your plant and your job depend for about two-thirds of the time on the efficiency of your watchman. You should keep watch on him.

Character and Appearance

The character, habits and reliability of the watchman should be unquestioned. He should never smoke while on his tour of duty, but may be permitted to smoke at a specified place during his rest period. Proper ash receptacles should be provided for disposal of discarded smoking materials.

A good personal appearance is a most desirable quality. A clean shave, clean clothes and well-shined shoes create respect from others, which is a great help in the performance of duties.

Courtesy and Control

Courtesy and self-control are absolute requirements and always should be practiced when contacting fellow employees and the public. Whether it be in the enforcing of a company rule or in the ordinary performance of duty, the watchman should be firm, calm and, above all, courteous. Whatever the watchman's assignment may be, he should do his work as he has been instructed, protect the employees and plant properties and do it in a pleasant and courteous manner.

Such behavior is an expression of respect and it is something the company expects of the watchman in a difficult and trying situation.

The Watchman's Duty

It should be the duty of the watchman to be able to discover the existence of fires, investigate any unusual odors such

as gas or smoke and be able to take the necessary action to eliminate any condition which might cause fire or explosion. He should be able to find leakage from water mains, sprinkler systems, steam lines, oil lines and other piping systems. He should prevent trespassing and losses due to theft and should not permit visiting, even with personal acquaintances. He should have keen observation and should note any evidence of infraction of plant rules and report them promptly. He should know the locations of all portable fire extinguishers and how to use them.

There are numerous types of fire extinguishers and it is very important that all watchmen be familiar with each type as all are not effective on all types of fires. Watchmen should be trained specifically in the use of all types of fire extinguishers. They should be familiar with the NFPA Standards for First Aid Fire Appliances (NBFU Pamphlet No. 10) and should receive the training described on Pages 70 to 86, inclusive, of the Industrial Fire Brigades' Training Manual published by the National Fire Protection Association.

The watchman must by all means know how to give a fire alarm and must do so at once and must summon aid if a fire is discovered or if sprinkler alarms operate. Knowing exactly how to give the alarm is the watchman's first duty. Secondly, he must understand clearly that he must not attempt to extinguish incipient fires without first giving an alarm or summoning aid. He should not hesitate to call the municipal fire department.

The Watchman's Reports

The watchman should be required and encouraged to keep a daily report preferably on a regular printed form. This report should contain a list of items pertaining to the hazards of the particular plant and also will serve as a constant reminder of what the watchman should look for in making his tours of duty.

The real purpose of the daily report is to bring to the attention of responsible parties all dangerous and unsatisfactory conditions.

Rounds

The watchman should report for duty at a stated time shortly before the departure of those whose responsibilities he assumes. This will enable the man on the preceding shift to pass on any information necessary to the man who follows. If the watchman is unable to report for duty for any reason, he should be sure to notify his employer in plenty of time so that a substitute may be obtained.

Good property protection requires that rounds should be made hourly during non-operating periods. Hourly rounds should be made at night from 6:00 P.M. until 6:00 A.M., except that some modification may be made in such occupancies as hotels and hospitals, where the first round should start when the kitchen force goes off duty, but not later than 9:00 P.M. Even though the plant is operating on a twenty-four-hour schedule, hourly rounds should be made at night because the officials of the plant are not present and the same supervision which is present in the daytime is lacking. Furthermore, employees are not so alert at night as during the daytime. Rounds should be made on Sundays, holidays and at other times when the plant is not in full operation.

The inspection department having jurisdiction always should be consulted and its approval secured of plans to be adopted at each individual property. The watchman's route thus can be laid out to the best advantage and so that all hazards at the plant are covered.

The First Round

The first round after the changing of work shifts is the most important round of the watchman's tour of duty. It is on this round that many conditions which are apt to cause fires or other losses can be discovered. Many employees in the rush to complete the day's work and to leave the premises on time are prone to overlook small things which, if neglected, may develop into extreme hazards.

Some of the important things to check on the first round are:

1. Outside doors and gates should be closed and locked, windows, skylights, fire doors and fire shutters should be closed.

2. All oily waste, rags, paint residue, rubbish, etc., should be removed from buildings or placed in approved containers.

3. All fire apparatus should be in place and not obstructed.

4. Aisles should be clear.

5. Motors or machines carelessly left running should be turned off.

6. Discarded cigar or cigarette butts or burned matches should not be left in areas where smoking is not permitted.

7. All gas and electric heaters, coal and oil stoves and other heating devices on the premises should be checked.

8. All hazardous manufacturing processes should be left in a safe condition. The temperature of dryers, annealing furnaces, etc., which continue to operate during the night and weekends should be noted on all records.

9. Hazardous materials, such as gasoline, rubber cement and other flammable and highly volatile combustibles should be kept in proper containers or removed from buildings.

10. All sprinkler valves should be open with gauges indicating proper pressures. If not open, the fact should be reported immediately.

11. All rooms should be checked during cold weather to determine if they are heated properly.

12. All water faucets and air valves found leaking should be closed. If unable to stop leaks, the condition should be reported.

The Watchman's Route

Two important parts of good property protection are carefully laid out routes and reliable watchman's recording systems. A plan or other record of the route should be prepared and posted in the watchman's headquarters.

The route should be so laid out that the watchman is required to pass through the entire area. It should not force him to retrace his steps. It should be laid out so as to prevent shortcuts by stairways, elevators or bridges. The entire route should not require more than forty minutes time.

Watchman's Recording Systems

In order to ascertain that the watchman actually is covering his route, a clock record of his movements should be maintained. Such records are required by inspection departments having jurisdiction where credit is allowed in insurance rates for watchman's service. Several methods and systems are available for this purpose. Central station watchman's service is the best supervisory service obtainable. It has been found to be the most reliable and trustworthy and the largest credits in fire insurance rates are given for this type of service. It is available for small plants as well as large ones. Where the plant is large and a number of watchmen are employed, the private proprietary system can be installed. By using this method, the operator located at the control center can supervise the movements of the watchmen on their routes. At operations where only a few men are required, portable watchman's clocks may be used.

All recording apparatus should be of an approved make and should be installed strictly in accordance with the NFPA standards and subject to the approval of the inspection department having jurisdiction.

Time Record Charts and Reports

The time record charts should be changed by the manager or other responsible person. The watchman should not be permitted to change the time charts in his own time recording apparatus. Time charts and watchman's reports should be reviewed carefully by the management who should note any irregularities and investigate immediately and thoroughly. When the watchman's reports are reviewed, the watchman should be advised as to the action that will be taken. If no action is to be taken, reasons should be explained to him.

The time record charts and watchman's reports should be dated and filed pending periodic review by the inspection department having jurisdiction.

Number of Watchmen Required

Due to the present wage and hour laws it is almost impossible for a plant to employ only one watchman, especially when the plant must be patrolled from 6:00 P.M. to 6:00 A.M. or for a period of twelve hours a night. Most watchmen will be on duty for an eight-hour shift and must be relieved for the remaining four hours. There also must be separate watchmen for the daytime shifts on Sundays, holidays and at other times when the plant is not in full operation. Enough watchmen should be provided so that each man can cover his assigned route in forty minutes, allowing ample time to check valves, windows, doors, lights, etc.

It is not good judgment to cut down the rest period, shorten the route by omitting any building or room or to exceed the hourly interval between rounds.

Where two or more watchmen are employed, one should be appointed as supervisor.

Watchmen should not begin their rounds at the same time and should not have the same rest period. The rounds should be scheduled so that rest periods will be separate, thus insuring maximum protection.

When there are two or more men, the routes should be patrolled by the same man, who will be wholly responsible for anything that occurs on his assigned route during his shift. This is preferable to the plan of alternating every other round. Routes may be varied from time to time if desired, but should not be changed during any one shift.

It is a good plan where there are two or more watchmen on duty and no supervisor or central supervisory system is employed to adopt a system whereby the watchmen should check with each other on every round so that in case of sickness or accident, an investigation can be made and help summoned.

Knowing the Premises

The watchman should become thoroughly acquainted with the premises. This includes all buildings and occupancies, yard areas, entrances and roadways in all parts of the property.

The watchman, when properly instructed, should know:

1. How to call outside fire and police departments or other emergency help.
2. The property in its entirety including all stairway terminals, elevator shafts, etc.
3. Locations of all fire exits.
4. Locations of all fire alarm boxes — local and municipal.
5. Locations of telephones.
6. How to start and operate fire pumps.
7. Locations of valves controlling sprinkler systems, inside riser valves, post indicator valves and sectional valves.
8. The locations and purpose of all valves controlling mill service, steam and gas lines.
9. The locations of fire extinguishers, hydrants, standpipes and small hose.

10. Location of dangerous or extra-hazardous machinery or materials.

11. The location and care of hazardous manufacturing processes, especially those continuing during the night, holidays and weekends, such as dryers, heat treating furnaces, etc., also, proper temperatures at which these devices can operate safely.

12. The electrical equipment, how to use switches so as to control the power and lighting systems when necessary and how to shut off current in case of emergency. Some of the items of electrical equipment which are likely to cause trouble are:

a. Sump pumps.
b. Air conditioning systems.
c. Ventilating systems.
d. Safety controls on furnaces and ovens.
e. Refrigerating equipment.
f. Fuse boxes.
g. Extension cords.
h. Electric heaters.

The Private Fire Brigade

All watchmen should be considered as members of the private fire brigade, if any, and should receive instruction with the private fire brigade's members, whenever possible. Again, it should be stressed that the watchman has sole custody of the plant and the jobs of all employees as much as two-thirds of the time and first aid fire fighting equipment such as is used by the private fire brigade is useless when the watchman is the only person on the premises and is not trained in its use.

The Watchman's Light

The watchman should be provided with a dependable electric lantern or flashlight. If he must pass through areas subject to flammable vapors, dust or flyings, he should have an explosion-proof flashlight approved for such areas. He should never be permitted to carry an oil lantern. Many fires have been caused by breakage of oil lanterns when dropped or upset or when the watchman has tripped and fallen. In some cases the watchman has lost his life in fires caused by such accidents.

Watchman Failures

Notwithstanding the fact that well-trained watchmen are "worth their weight in gold" when properly trained and many times have prevented small fires from spreading into near-catastrophes, there have been a number of cases where the watchmen have failed, mainly due to the fact that proper care was not exercised in their selection and because they were not given the proper training, not only when they were employed, but at stated intervals. There are many examples of watchman failures, but a few might be of interest.

On April 19, 1948, in a chemical works in Ohio, from all appearances a fire originated on the first floor of the three-story brick wooden joisted manufacturing building in an area where a large quantity of knockdown corrugated cartons was stored. At 8:30 P.M. the watchman went to a restaurant near by for a sandwich and a glass of beer. Returning at 9:30 P.M. he heard a peculiar noise and upon investigation, discovered a serious fire in the main plant and called the municipal fire department. The loss was $486,000.

On October 8, 1948, in a food products warehouse in North Carolina, according to the watchman's statement, fire, when first discovered, involved empty egg crates on a loading platform. When the forty-gallon wheeled soda-acid extinguisher which he had gone to get would not go through the door opening, he tried using several 2½-gallon extinguishers, but without effect. Approximately thirty minutes after discovery, by which time the fire was beyond control in the one-story brick wooden joisted building, the alarm was sent to the municipal fire department. The loss was $2,260,000.

Here is a case where the watchman became confused probably because he was

not trained properly, and where he violated the hard and fast rule of "Always call the municipal fire department first before trying to extinguish a fire."

On May 2, 1948, in a department store in Illinois, it is the opinion of the municipal fire department that lightning struck the six-story fire-resistive building during a severe electrical storm. At 12:00 midnight a fire company returning to quarters noticed fire in the third and fourth floors of the building. Up to this time, the fire had not been discovered by the watchman and no alarm had been turned in. The loss was $1,650,000.

In the May, 1950 issue of N.F.P.A. *Fire News* there are two examples of watchman failure. In the first, in a retail lumber yard in Toledo, Ohio, the fire was discovered by an outsider at 4:10 A.M., five minutes before the 79-year-old watchman was to start his hourly round. On his 3:15 A.M. tour, the watchman had fired the basement boiler with sawdust and shavings at which time it is believed sparks ignited wood waste stored in front of the boiler. The loss was $215,000.

The second case, in cotton compress at Chickasha, Oklahoma, was discovered by the watchman at 2:30 P.M. as he was returning to the office from his 2:00 P.M. round. Instead of giving the alarm, the watchman attempted to use an inside hose, but was forced from the building by the fast spreading fire. He was directing an outside hose line on the office when the fire department arrived, having been summoned by an outsider. The loss was $500,000.

Here again, the watchman failed by not calling the fire department before attempting to fight the fire.

These are but a few of a long list of large fires involving watchman failure. Had the proper type of watchmen been employed and had they been trained properly, it is possible that many of the large losses could have been held to a minimum.

Summary

The watchman of today is entirely different from the one of years ago. The watchman today is a highly trained, efficient employee, who is physically and mentally able to do the job which is assigned to him. He is not the aged employee who has been given the job of watchman when he should have been pensioned and allowed to bask in the sunshine. The watchman today should be considered as one of the most important employees in the plant.

The watchman of today is an important link in a plant's organization. He should be so selected and trained that it will be taken as a high compliment to him that he has been trusted with the responsibility of protecting your plant and the jobs of your employees for as much as two-thirds of the time. More power to him.

The Committee on Fire Brigades and Watchmen has prepared a new brochure entitled "The Watchman" which eventually will be presented to the membership of this association for adoption. It is not quite in its final state, but it is hoped that it will be ready for adoption at the next annual meeting. Much of the material I have used here will be contained in that pamphlet.

Radioactive Materials In Fires

Fire departments and others have been concerned about the possible personal hazard involved in fighting fires in buildings where radioactive materials are stored or handled, but without any authoritative information as to the extent of the hazard or the measures that should be taken for personal safety in various situations. While the subject is highly technical and complicated, it is apparently not necessary to be a nuclear physicist to understand enough about the hazard to take reasonable measures for personal safety. The best statement that we have seen on this subject is an address by Dr. L. G. Cook of the Chemistry Branch, Atomic Energy Project, National Research Council, Chalk River, Ontario, presented at the Fire Protection Conference of the Canadian Manufacturers' Association in Toronto on May 26, 1950. Following is an extract from this address:

Pretend I was suddenly made Assistant Fire Chief in say, Toronto, with the duty of leading my men into every fire where any radioactive hazard was suspected, not necessarily as a fireman, but as a sort of hostage — a guarantee that if I wasn't frightened, they needn't be.

Well, first of all I should recognize about five degrees of fright in such fires. In order they are:

1. Fires following an atomic bomb.
2. Fires following the explosion of a reactor.
3. Fire in a plant where large quantities (10's of grams) of radioactive materials are processed — i.e. a radium processing plant, a plutonium extraction plant or the like.
4. Fire in an area where small quantities (mgs. to gms.) of radium or similar material are handled — i.e. a plant making radium luminous dials, preparing radioactive isotopes for industry or the like.
5. Fire in an area where tracer amounts of (less than a mg.) radioactive materials are in use — such as University Labs., etc.

1. As far as fires following an atomic bomb are concerned that is a province of civilian defense and I would like to hear someone tell me what to do as much as you would.

2. As to fires following a reactor explosion, there are only two reactors in Canada and both are under the care of the authorities. As leader of a municipal brigade, I should lead my men energetically in the other direction.

3. As to large scale processing plants, so far as I know there are only two — one at Port Hope and one at Chalk River. In case of fire in either, I should diligently lead my brigade in the opposite direction and allow the plant employees who know where the hazards are — the full responsibility of fighting the fire or letting it burn down as they pleased. That business is too risky for anyone not intimately familiar with the plant to deal in.

The reason for this is that the *only* hazard in such fires is that one inhales or ingests or gets in a cut a small amount of radium or plutonium dust. As little as one millionth of a gram in the body is almost sure to cause trouble in 20 years or so. It is just a normal odorless poison dust hazard with delayed action.

If it *were* necessary to be around the outskirts of the fire to protect houses in the vicinity I should insist on wearing a good dust mask.

4. Now we come to the only group of hazards with which a municipal fire department should ever have to deal. This consists of mgs. to gms. of radium or other equivalent radioactive material present in a radium dial painting plant, in a hospital, in an industrial plant, in a University, or in an express car, truck, aeroplane, or other conveyance.

The only hazard the fireman need fear is that

of breathing in or ingesting some of the material or getting it in a cut.

I know that in Toronto there are materials in all of these places.

I should go to each of these places and find out:

a) how much material they had

b) whether it was in the form of powder or solution, or a hard metallic chunk

c) how it was contained — whether in fragile glass, easily melted lead, a sealed container which although it might not melt, might explode and shoot out its dust

d) whether it was moved around or whether it always stayed in the same location.

Then I should lay my plans in case of fire based on the assumption that under no circumstances did I intend to inhale any of the stuff as dust, or eat it, even at the risk of letting the place burn down. I am sure that the owners of the stuff faced with the threat of no fire protection would quickly co-operate to keep it always in one place known to me, or to keep it in stronger containers. Usually people just do not think much about these problems but can easily solve them when they are put to them.

Another thing I would like to be able to have or borrow after such a fire would be a Geiger counter. The purpose of this is to find the stuff again. It is important to find it again — not so much for the owner's sake because it is probably insured — but to make sure none of my firemen had accidentally got some of the stuff in his trouser cuff. It wouldn't do him any harm for weeks — but if he carried much of it around in his trouser cuff or vest pocket for months he might get a bit of a burn on his skin — or worse still from rubbing his vest or trouser cuff with his fingers, then his tobacco pouch and pipe and get some into his system. A Geiger counter is not expensive; there are many about. And the fire chief in a municipality where there are radioactive materials should know where he can borrow one the day after the fire to give his men the once over — and if possible locate all the missing material in the ruins.

Well that is all there is to it. I can think of so many chemicals I would much rather not face in a fire that this problem seems easy — but one must take these elementary precautions — if one is careless and does breathe in some of the radioactive dust it can be very serious in a few years' time.

5. Finally the tracer amounts usually used in University or research laboratories are perfectly harmless.

Of course in applying these ideas it is necessary to have reliable knowledge of the amounts of material present. One must be on one's guard against general statements about quantities. If you have any reason to think the quantities of material present are being misrepresented, borrow your Geiger counter and check up.

I am afraid this is very un-technical. Nothing about isotopes, nuclear physics, atoms, y-rays, a-rays, B-rays, etc.

But I assumed I was not asked to give you a lecture on nuclear physics, but to tell you exactly what I would do if responsible for fire protection of locations where there might be radioactive materials.

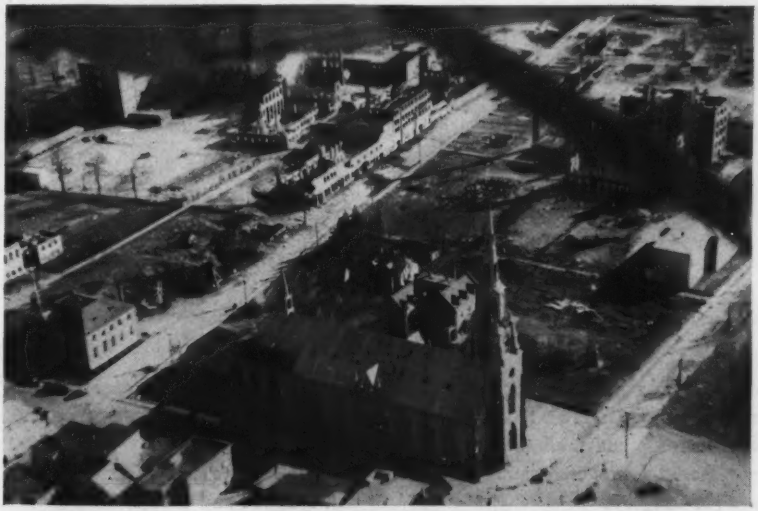
I work daily in a building housing mgs. to gms. of material of about the hazard of radium and I have told you exactly what I will do there if there is ever a fire.

Rimouski And Cabano Conflagrations

Within one week the Province of Quebec was the scene of two conflagrations in May, 1950. The circumstances responsible for these sweeping fires were the same in each instance — a severe lumber yard exposure, high winds, dry weather, flying brands and lack of an adequate supply of fire-fighting manpower and equipment during the early stages. One or more of these factors has had a vital part in most of the world's peacetime conflagrations. Conflagration prevention is discussed in detail in Chapter 67 of the NFPA Handbook of Fire Protection, tenth edition. Some of the means of reducing the hazard are: systematic city planning and zoning, requirements for a high standard of building construction, elimination of combustible roof coverings, adequate exposure protection, razing of conflagration breeders, use of automatic sprinklers, improved public water supplies and fire department efficiency, and complete municipal fire alarm and radio communication systems.

Rimouski

Rimouski is a community of 15,000 population situated at the confluence of the St. Lawrence and Rimouski Rivers on the south bank of the St. Lawrence River. The Rimouski River divides the city into two segments. On May 6 fire starting in the lumber yard of Price Bros. and Co., Ltd., on the west bank of the Rimouski River destroyed the lumber yard and two sprinklered lumber mills, jumped the river and razed 319 homes, 20 stores, a movie theatre, hotel, court house and jail, the 4-story brick St. Joseph's Hospital, a new three million dollar technical school,



The large stone Rimouski Cathedral across the path of the flames successfully withstood the fire and was an effective barrier to further spread. The roof of the cathedral was fire retardant.

Wide World

Air view of part of the Rimouski conflagration damage. The fire originated in a lumber yard, jumped a 200-foot-wide river and destroyed 319 homes, 20 stores, a movie theatre, hotel, court house and jail, the 4-story brick St. Joseph's Hospital, a new $3,000,000 technical school, a convent and the old Rimouski Seminary. No lives were lost but more than 2,000 were made homeless. Most of the large brick buildings visible in the picture were destroyed.

a convent and the old Rimouski Seminary. No lives were lost. More than 2,000 were made homeless and preliminary estimates place the total property damage at more than $16,000,000.

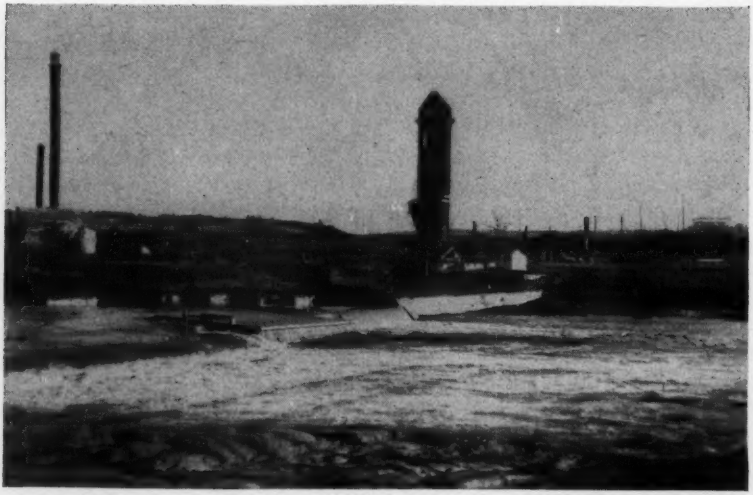
The weather had been dry for several days prior to the fire. Wind velocities had been steadily increasing on May 6 and by midafternoon were varying between 60 and 75 mph. Around 5:00 P.M. a pole carrying high tension wires to the lumber mill snapped and dropped live wires into the yard. Arcing set fire to piles of lumber and within minutes the entire lum-

ber yard which contained an estimated 15,000,000 feet of drying lumber was a sea of flames. The two mill buildings were also soon enveloped and burning pieces of lumber as well as clouds of embers and sparks carried by the high wind were falling into the residential district of the city across the 200-ft.-wide river. The fact that there were very few buildings with combustible roof coverings is undoubtedly the reason why so large a part of the town was saved, as the roofs were under a constant shower of small sparks.

Dozens of fires were set among the closely built, for the most part wooden houses by wind-borne flaming boards, many of which entered windows. There appeared to be some hope of preventing a major conflagration at this stage provided sufficient hose streams could be put in operation. Calls for help were sent to all surrounding communities. However, planking on the Rimouski River bridge burned cutting off the main approach to the city and curious motorists clogged roads from other directions. Eventually, a number of outside fire companies arrived to help but discovered that the city's water system was unable to supply the demand made by so many hose streams.

During the night flames spread through dwellings on St. Germain Street that paralleled the bank of the St. Lawrence River, and St. Therese Street, one block inland. One after another, families packed what belongings they could and abandoned their homes. The 250 patients at St. Joseph's Hospital were moved twice; first to the city's home for aged and orphans, and later when this structure was also in imminent danger, to hospitals in Manate and Mt. Joli. One hundred and fifty aged and 150 orphans were also evacuated. The 43 prisoners in the jail

Not all buildings in the path of the flames at Rimouski were destroyed. Fire retardant roofs and a good deal of effective fire fighting by householders and firemen saved several buildings.



This picture shows the Rimouski River and the lumber yard on the far shore, where the fire started.

were chained together and moved to safety.

It was feared that the Rimouski Cathedral that stood athwart the path of the flames would be destroyed, but the huge stone cruciform structure withstood the attack and was a major factor in preventing spread to buildings beyond. By morning the wind had slackened materially and shifted, thereby relieving the threat to the Cathedral, but at the same time endangering the business district inland. However, fire fighters were able to prevent major damage to this area and by midnight Sunday the fire was under control.

Cabano

On May 9, Cabano was the scene of the second Quebec conflagration in four days. Cabano is a lumber milling town of about 3,200 persons, 50 miles south of Rimouski, and situated on the shore of Lake Temiscouata. Contributing factors in this instance were strikingly similar to those at Rimouski — lumber yard, high winds, dry weather, combustible construction, flying brands, and insufficient public fire protection to combat successfully several simultaneous fires. No lives were lost, but destruction of 118 houses left 1,800 homeless. Thirty-three business establishments, including a lumber yard, lumber mill, three hotels, a bank and miscellaneous stores and offices were destroyed. Loss is estimated at $6,000,000.

Cabano had experienced the same dry weather as Rimouski but the winds were not so severe; estimated velocity on May 9 was 25-30 mph. At 10:30 A.M. sparks from the stack of a waste burner at the planing mill of George Pelletier landed in 85 cords of dry maple wood. Flames spread quickly through the wood, jumped to a near-by small garage, then to the wooden Lacenais Hotel. Burning embers

Air view of the Cabano conflagration on May 9. The fire destroyed 118 houses, 33 business establishments, including a lumber yard, lumber mill, three hotels, a bank, and miscellaneous stores and offices. Loss was $6,000,000.

carried by the wind set fires in four parts of the town and within 15 minutes two dozen buildings were in flames and the fire was completely out of hand. Residents gathered up what they could readily carry and left their homes to the flames that zig-zagged across six streets. Help was summoned. As in the Rimouski conflagration, roads congested with the curious delayed response, but eventually apparatus and manpower from six neighboring communities arrived at the scene. The wind died down at nightfall, permitting firemen to bring the fire under control.

Fires In "Fireproof" Buildings

In an effort to provide a building that will guarantee the maximum in life safety for its occupants, and will offer the best possible protection against serious property damage several features of building design and protection have been developed which in concert can make a building fire-safe. Fire-resistive construction has made a major contribution toward this goal; but it alone does not make a fire-safe building and only when all features of design and protection are adopted can the ideal degree of fire safety be attained. Proper exits, protection of vertical openings, limitation of areas, restricted use of combustible interior finish, suitable fire protection equipment, explosion venting where the hazard exists, employee training for fire safety are among the other indispensible features of good fire protection. It is the purpose of this fire record to emphasize that the fire safety of a building depends on all of these features.

Fire-resistive construction has made a major contribution toward life safety and reduction of property damage from fire. The National Fire Protection Association has consistently called attention to the value of this construction and urged its use. There is, however, a widespread misunderstanding, to some extent corrected by recent fire experience cited in this record, that fire-resistive construction in itself offers complete protection against disastrous fires. The unfortunate choice of the word "fireproof" to describe this construction when first developed has had much to do with this false belief. No type of construction is "proof against fire."

What is a fire-resistive building? What protection does it provide and what are its limitations? It is defined in the NFPA Handbook of Fire Protection as follows: "As ordinarily used the term 'fire-resistive building' refers to a building with structural members constructed of noncombustible materials of such quality and so protected that they will resist the maximum severity of fire expected within the structure without collapse. Fire-resistive structures do not contribute to a fire following the ignition of combustible contents, and are thus of great value in reducing the possibility of loss of life and property."

Structural members referred to in the definition include walls of masonry, reinforced concrete or other noncombustible material with the required degree of fire protection, framing of reinforced concrete or steel protected by fire-resistive materials, and other structural members such as floors, roof and permanent partitions also constructed of protected noncombustible materials. It will be noted that the fire resistance for these structural members should be sufficient to withstand the maximum fire expected, a significant point in the definition. Resistance requirements of a building therefore depend upon the combustibility of its contents. In other words the degree of fire resistance required for a building with a small amount of combustible contents, such as an office building, is less than that required for a furniture warehouse.

For this reason modern building codes usually recognize three types of fire-resistive buildings with different degrees of fire-resistance, commonly referred to as 3-hour, 2-hour and 1-hour buildings. The codes also indicate the occupancies for which each classification is suitable. These ratings are based upon standard fire tests that measure the time a structural mem-

ber protected by a particular type and amount of fire-resistive material will withstand fire before failure.

Although general acceptance of the theory that fire-resistance is relative represents a radical departure from early requirements which called for the maximum fire-resistance in every fire-resistive building, the soundness of the present-day conception that the combustibility of the contents of a building determines its fire-resistance requirements has been substantiated by fire experience. It does, however, introduce a serious problem when the occupancy of a fire-resistive building changes, since a substantial increase in occupancy hazard may in effect render a structure no longer "fire-resistive." Failure to recognize the importance of this feature of fire-resistive construction has been responsible for severe structural damage in several fires, the rubber warehouse fire in North Kansas City, Mo., March 15, 1950 being a recent example.

If a fire-resistive structure *does* possess the proper degree of fire-resistance, it *will* resist a fire without collapse and by virtue of the noncombustibility of construction materials will not contribute fuel to the fire. To this extent fire-resistive construction protects life and property.

What does fire-resistive construction not do? It does not prevent fires, — accomplished by a fire prevention program for employees. It does not detect fires, — accomplished by trained watchmen, alert employees, and automatic detection equipment. It does not guarantee the safe evacuation of the occupants, — accomplished by adequate exits for safe escape from any part of the building. It does not limit fire spread, — accomplished by fire divisions and fire partitions with all openings protected. It does not prevent vertical spread of fire, — accomplished by enclosure of stairways, elevator shafts and other vertical openings. It does not prevent explosion damage, — accomplished by facilities for explosion venting. It does not prevent exposure fire from involving the contents of a fire-resistive building, — accomplished by fire doors, shutters, outside sprinklers, wired-glass windows and removal of serious exposure hazards; and fire-resistive construction does not extinguish fires, — accomplished by automatic sprinklers, fire extinguishers, special fire-extinguishing equipment and private and public fire departments.

Fire-resistive construction is one of many features of design and protection which together provide a fire-safe building. No one of them, in itself can guarantee this protection. Had this fact been more widely recognized, the awful toll in lives and property destruction recorded on the following pages would not have occurred.

The incidents selected represent more than $25,000,000 destruction and are a small sample of fires and explosions in the files of the NFPA that have occurred in fire-resistive buildings since 1940.

In the 32 fires and explosion incidents cited, 760 lives were lost, including 31 in manufacturing plants, 22 in storage occupancies, 32 in office buildings, 180 in hotels, three in a hangar and 492 in a night club. In eight cases fire originated outside and spread into the fire-resistive building. Severe explosions were responsible for extensive damage in nine.

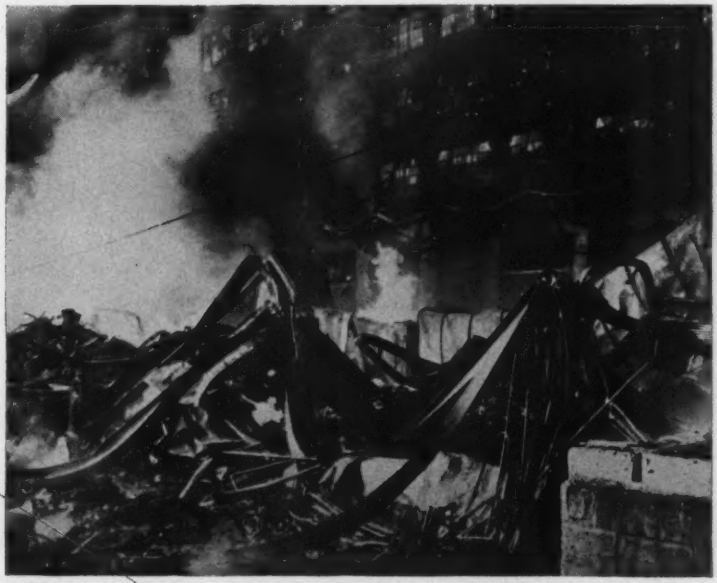
Where it was possible to separate building and contents losses approximately 27 per cent of the total damage was structural, not considered an unusual condition in fires and explosions occurring in fire-resistive buildings lacking automatic protection for high values often contained in such structures.

Occupancy of this new 9-story, reinforced concrete cereal mill in Buffalo, N. Y., before fire protection had been completed resulted in a loss of more than $500,000 on February 15, 1940. Sprinklers were not as yet in service and protection for several of the vertical openings had not been installed. The fire originated on the fourth floor in a huge pile of cardboard packing cases and spread through unprotected vertical openings to 60 carloads of cereals in packages on the fifth, sixth and seventh floors. All stock on these floors was ruined, and new machinery was damaged.

The principal structural damage resulted from direct exposure of the underside of the 7- and 8-inch floor slabs at fairly close range. The seventh-floor slabs suffered the most serious damage, and on this floor approximately 60 per cent of the total floor area of 24,000 sq. ft. was materially damaged. On the eighth floor approximately 40 per cent of the total area was damaged, on the sixth floor 25 per cent, and on the fifth floor 30 per cent. The minimum damage in these areas consisted of spalling, which left the reinforcing steel exposed. The maximum damage occurred in areas where the entire floor slab was completely cracked.

International

Flames are coming from windows of a grease processing building of fire-resistive construction in an oil refinery at Marcus Hook, Pa., Sept. 4, 1943. Upon arrival of the first fire company the contents of the entire building were in flames and six hours later when the fire had been extinguished the contents were destroyed and the building badly spalled. Loss was $350,000.



The contents of the unsprinklered 8-story reinforced concrete flour mill in the background suffered extensive damage from fire that originated in a pile of crating material outdoors. The fire occurred near Ellicott City, Md., May 27, 1941. Flames spread before a 30 mph wind to a railroad trestle, along the trestle to a steel framed machine shop (foreground) and thence through windows to the sixth and seventh floors of the mill where shortening was stored in drums. Ignition of grease released from ruptured drums spread fire to all parts of both floors and intense heat subsequently caused ignition on lower floors. Loss $1,200,000.

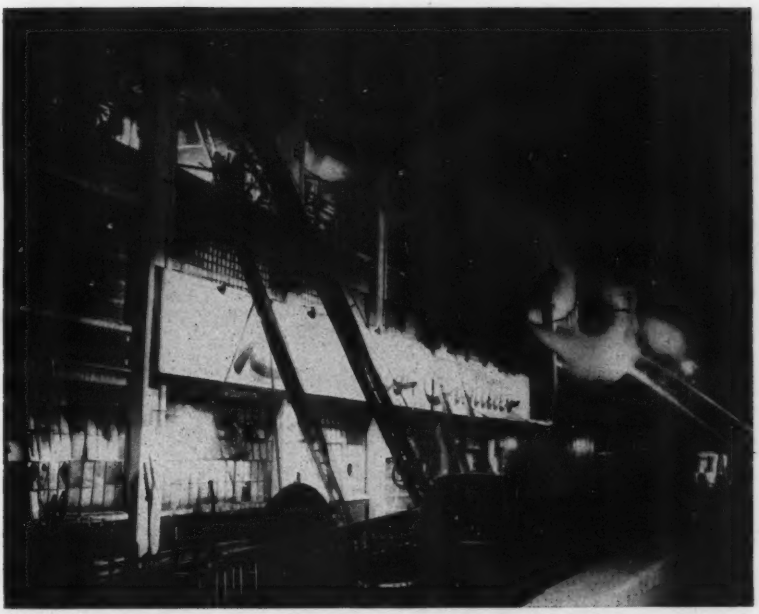
Associated Press

A static discharge at a benzol mixing tank was the cause of this fire at a Philadelphia chemical plant that destroyed three buildings on April 20, 1946. The fire originated in an unsprinklered 2-story reinforced concrete building. One of ten explosions blew off portions of the roof. Flames leaped 50 ft. in the air and spread to two adjoining 1-story buildings constructed of brick walls and wood roof on steel girders. Loss $1,725,000.

Star-Ledger

The rubble in the foreground is all that remained of a reinforced concrete building 180 by 190 ft. in area and 50 ft. high following an explosion of naphtha vapors on August 19, 1943 at Kearny, N. J. Twelve men were killed in the blast that originated in a drying cell used for drying cloth following a waterproofing process.

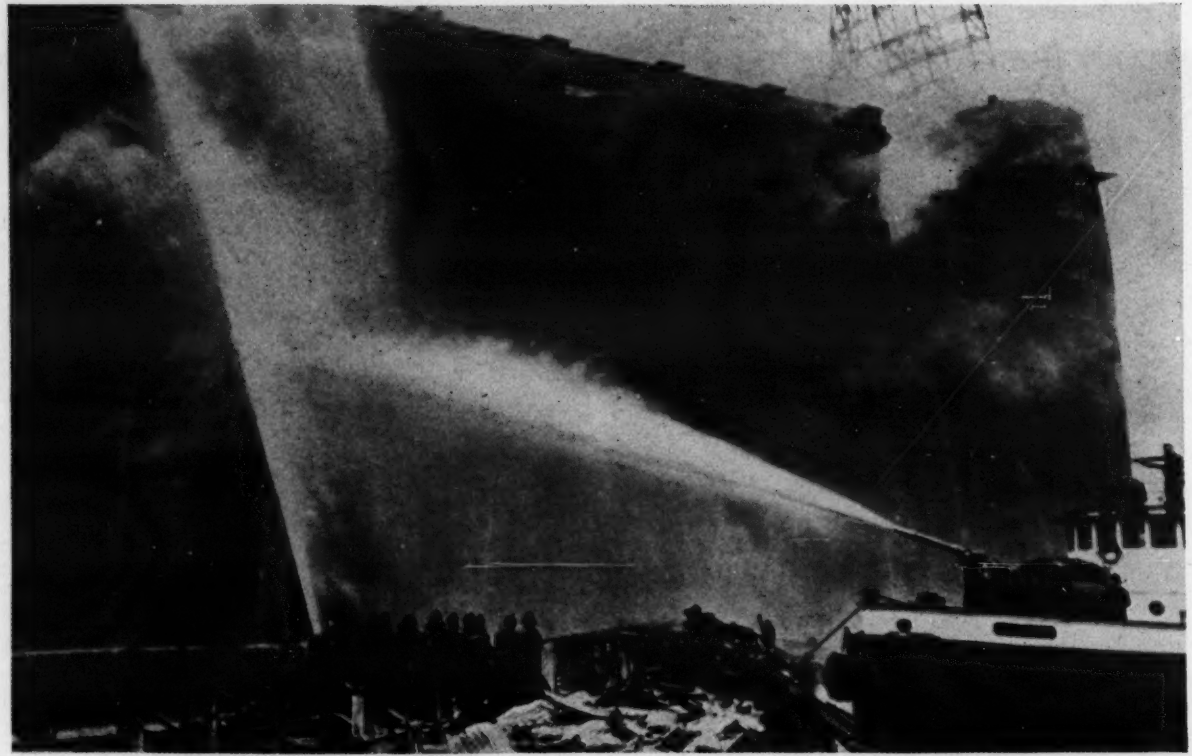
The degree of destruction that may be expected where an explosion of flammable vapors occurs in a reinforced concrete building without explosion relief vents is shown here.



Wide World

An explosion of starch dust on the third floor of this 4-story fire-resistive candy factory killed 15 employees and wrecked the third and fourth floors. Brick wall panels and large metal-sash windows were blown out, concrete roof sections lifted, and partitions demolished. Damage was approximately $2,000,000. The explosion occurred in Chicago on Sept. 7, 1948.

The vulnerability of fire-resistive construction to violent explosion unless provided with large areas of explosion vents was again demonstrated by an explosion of hexane vapors in this fish oil extraction plant at Seattle, Washington, July 6, 1948. The one- and two-story building was constructed entirely of reinforced concrete. Four employees were killed and the structure reduced to rubble when escaping hexane vapors spread throughout the building and exploded. Property damage was $541,000.



On May 31, 1941, fire in cattle pens on the Jersey City waterfront spread across a 150 ft. slip to a wooden grain elevator and then jumped a 210 ft. slip to this 6-story reinforced concrete, sprinklered warehouse. The fire demonstrated the exposure hazard of wooden structures to fire-resistive buildings even when separated by wide spaces, and that automatic sprinklers cannot be expected to protect against severe exposure fire. The fire was an example of the serious structural damage that may be expected when quartz coarse aggregate is used. Seven interior columns on the fifth floor failed and part of the 5-inch-thick sixth floor and 4-inch roof collapsed. Many columns and girders were badly spalled.

The folly of connecting combustible structures to fire-resistive buildings was emphasized in the fire at a frozen food processing plant at Milton, Oregon, on March 5, 1949. The fire originated in the 1-story wooden cold storage section at right and spread through a large open doorway into the 3-story reinforced concrete processing building at left. This picture was taken after flames had spread up open stairways and conveyor openings and had broken through the wood roof on the otherwise reinforced concrete building. Loss $364,500.

Acme

The importance of subdividing fire areas and installing sprinklers in areas of combustible occupancy even though the structure is fire resistive was emphasized by fire on Dec. 15, 1948 at an automobile factory at Dearborn, Michigan. Fire originated in an unsprinklered area on the first floor mezzanine used for storage of cotton wadding, foam rubber, trim cloths, seat backs and burlap covered springs. Embers dropped through loosely fitting steel plate flooring of the mezzanine to the Body Trim line shown in picture. Both the mezzanine and first floor opened into a craneway extending the length of the building, thereby permitting heat from the fire to mushroom and open 2,650 sprinklers on the second floor on each side of the craneway, as well as at each end of the unsprinklered area on the first floor. Damage exceeded $1,500,000.

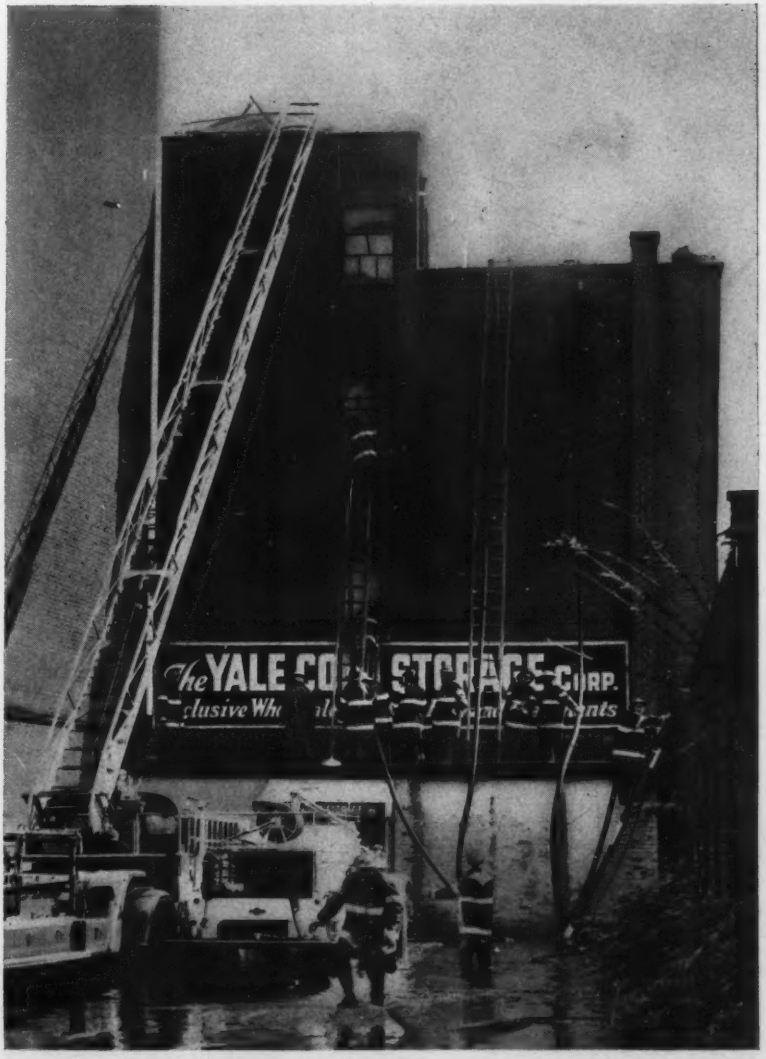
210 ft. slip to this 6-story reinforced concrete, sprinklered warehouse. The fire demonstrated the exposure hazard of wooden structures to fire-resistive buildings even when separated by wide spaces, and that automatic sprinklers cannot be expected to protect against severe exposure fire. The fire was an example of the serious structural damage that may be expected when quartz coarse aggregate is used. Seven interior columns on the fifth floor failed and part of the 5-inch-thick sixth floor and 4-inch roof collapsed. Many columns and girders were badly spalled.

Port Arthur News Chronicle

A section of the wreckage of a 2,100,000-bushel grain elevator after a dust explosion and fire on August 7, 1945, Port Arthur, Ontario. Twenty-two workmen were killed and many others seriously injured. Reinforced concrete walls 18 inches thick were blown out by the force of the blast that originated in the basement. There was an almost complete lack of dust control and dust removal equipment, and a very small venting area was provided.

Acme

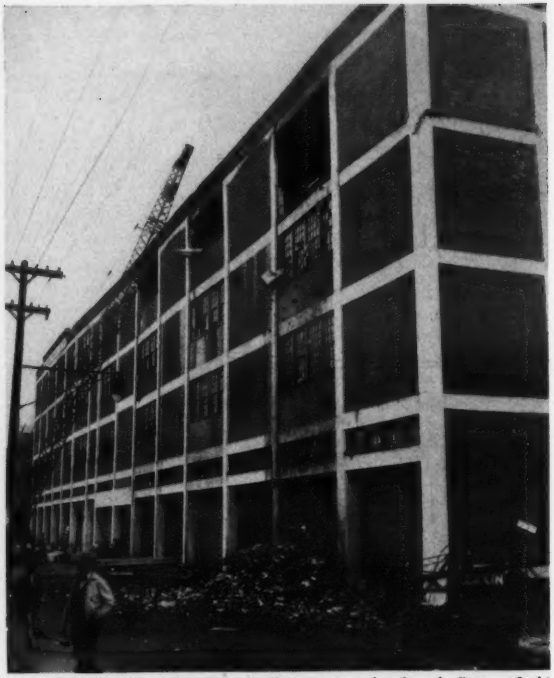
On January 28, 1949 an explosion occurred in a gas generating plant in Chicago. One employee was killed and the building demolished. The 3- to 14-story fire-resistive office and warehouse building shown above was 180 feet away. Approximately 50 occupants were injured when pressure waves blew in windows and damaged partitions on the exposed side.



Acme

An estimated $3,000,000 damage was caused to fur garments closely packed on all floors of this 3-story building on September 24, 1943 at New Haven, Connecticut. Construction features included 12-inch brick walls and reinforced concrete floors and roof. There were, however, openings in the floors for the circulation of air from floor to floor and other poorly protected openings for air ducts that permitted fire originating on the first floor to involve all areas. Flames and smoke spread through these openings to the upper floors. Damage to the building was $4,000.

Fire on the sixth floor of a 6-story reinforced concrete general warehouse in San Diego, March 11, 1942. Firemen had to break holes in the concrete roof to reach the fire. Lack of sprinklers, large undivided areas and delayed discovery contributed to the large loss. Fire was confined to the 10,000 sq. ft. sixth floor, but water poured down shafts and damaged stock stored without skids on undrained lower floors. Building damage $7,500; contents $250,000.



On May 27, 1950, fire broke out on the fourth floor of this unsprinklered 4-story warehouse in Philadelphia. Groceries were stacked from floor to ceiling on all stories and blocked all windows, preventing access to the fire. The fire burned 22 hours, during which time the 2-hour roof slab expanded from 15 to 18 inches and brick curtain walls at one end of the building at the fourth floor were pushed out about 9 inches at the floor level (see photo).

curtain walls at one end of the building at the fourth floor were pushed out about 9 inches at the floor level (see photo).

The owners of this undivided 21,575 sq. ft. 1-story fire-resistive electrical supplies warehouse in Little Rock, Ark., believed it to be immune to serious fire due to its construction—walls 8-inch brick faced hollow tile, roof reinforced concrete beams and slabs, and concrete floor. Overlooked were numerous wood stud hollow partitions sheathed with wood and combustible fibreboard, wooden storage decks and cabinets, and congested storage in excelsior and cardboard cartons. On March 23, 1949, fire destroyed the contents and heavily damaged the building itself, due to the inadequate degree of fire resistance of structural members for the fire load represented by the contents.

down shafts and damaged stock stored without skids on undrained lower floors. Building damage $7,500; contents $250,000.

This picture shows the effects of four hours of uncontrolled burning of high-piled combustible contents in the large-area, unsprinklered 1-story fire-resistive warehouse in Little Rock, Ark., March 23, 1949. Loss estimates totaling $256,800 included $36,800 damage to the $100,000 building and $220,000 to contents.

Acme

The vulnerability of fire-resistive buildings without automatic sprinkler protection to structural damage when exposed to severe contents fires is illustrated by this fire in a North Kansas City warehouse on March 15, 1950. An intense fire of 8½ hours' duration involving stored rubber tires and tubes caused collapse of much of the roof and two upper floors of this 31,200 sq. ft. 4-story reinforced concrete fire-resistive building. Floor slabs were 8 inches thick. Loss to the warehouse and an exposed 9-story fire-resistive multiple occupancy manufacturing building was approximately $3,775,000.

R. M. Hubbell

This picture shows the sprinklered 9-story fire-resistive multiple occupancy manufacturing building which was exposed by the rubber warehouse fire in North Kansas City, Mo., March 15, 1950 (see picture top of page). A 90-foot clear space separated the two buildings. All windows on the exposed side were broken, window frames on upper floors were ignited, and were it not for the operation of 100 sprinklers the contents of the building would almost certainly have been consumed.

Press Association

At 9:45 A.M., July 28, 1945, a B-25 bomber struck the Empire State Building with terrific force at the 78th and 79th floor level, causing flaming gasoline to be sprayed on the exterior and resulting in a flash fire in offices on the 79th floor and the 78th floor temporarily used in part for the storage of paints and painters' supplies. Eleven employees were burned fatally in the offices, which fortunately contained only a Saturday morning "skeleton" force. The New York Fire Department utilized the building's fine fire protection equipment to maximum advantage, bringing the flames under control within 19 minutes. Parts of the burning plane passed through the opposite wall and caused $75,000 damage to a penthouse apartment on a 12-story fire-resistive building across W. 33rd Street. Operation of five sprinklers in this building gave the alarm and held the fire in check until firemen arrived. Total loss was $500,000.

Explosion and fire in the 8-story fire-resistive New Post Office Building in Washington, D. C., on Nov. 1, 1949, caused an estimated $255,000 damage, of which $175,000 represented structural damage. Short circuit of electric cables caused wiring to overheat in concrete cable ducts above the eighth floor corridors. Flammable vapors distilled from the insulation escaped into concealed ceiling spaces and were exploded by arcing. Long stretches of ceiling and corridor partitions were blown down, a hole was blown in a transformer vault, and fibreboard thermal insulation installed above the suspended corridor ceiling was ignited.

The corridor partition was blown into this office on the eighth floor. New Post Office Building, Washington, D. C., November 1, 1949.

This 7-story fire-resistive office building in Duluth, Minnesota, was badly damaged by fire that originated in a 4-story brick, wood-joisted furniture store across a 65-ft. street. The fire occurred during the night of June 4, 1948. Despite prompt action by firemen using standpipe lines and hose dragged up through the building, heat broke windows and ignited wood window frames, combustible trim and office furniture in the otherwise fire-resistive building. The front 40 feet of each floor above the first was damaged and the contents of front offices completely destroyed. Losses in the fire-resistive building included $200,000 building damage, $35,000 rent loss, and $12,500 contents loss.

Acme

Fire involved a room approximately 20 ft. square and 59 ft. of the corridor on the 23rd floor of the 48-story fire-resistive Woolworth Building in New York on April 7, 1950. Flames destroyed the contents of the room and badly damaged the interior finish, plaster and electrical equipment. The corridor was badly damaged by fire, smoke and water.

A. H. Pruett, Jr.

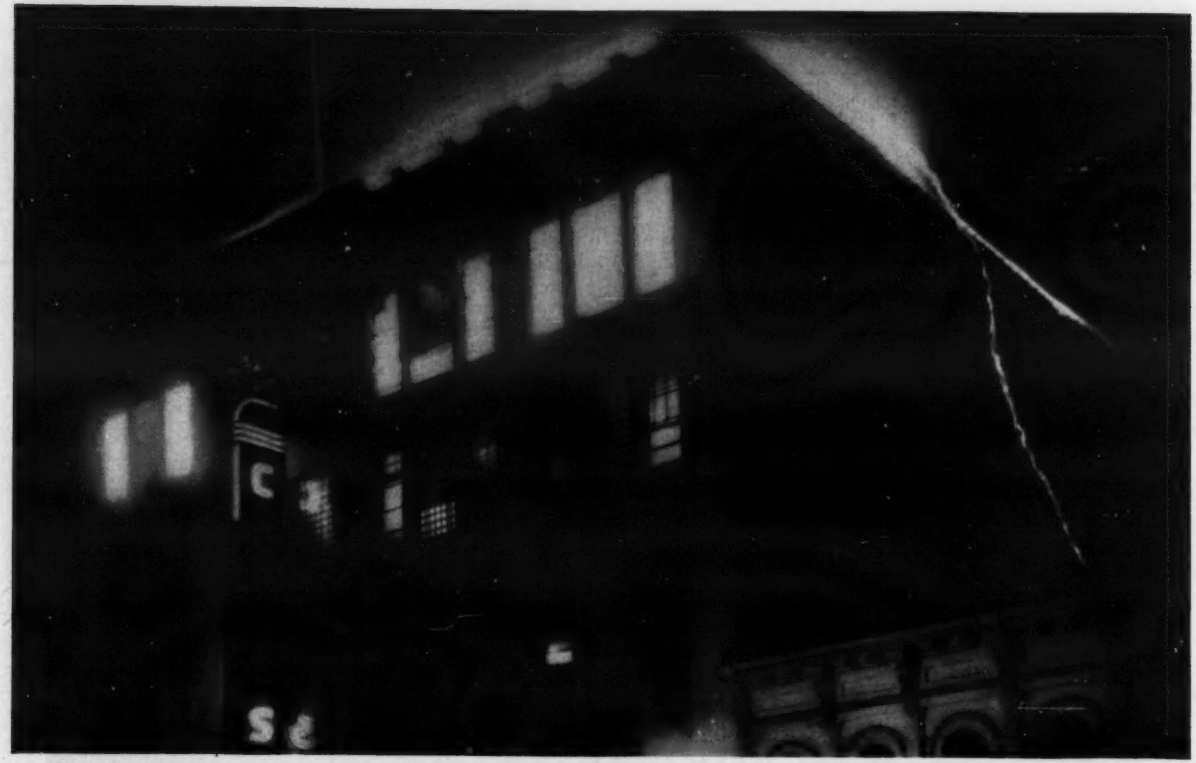
The unsprinklered 7-story fire-resistive Charleston National Bank Building was endangered by fire in an adjoining 3-story brick, wood-joisted building in Charleston, W. Va., March 4, 1949. Flames and heat threatened to enter plain glass windows on upper floors and was only prevented from doing so by firemen stationed with hose lines on upper floors. Fire damage was confined to broken windows and scorched wood window frames. Total loss was $400,000, of which $10,000 represented damage to the bank building.

Acme

Twenty-one employees at work in this 6-story fire-resistive office and meat packing building in Sioux City, Iowa, were killed and 91 were injured by an explosion on December 14, 1949. An accumulation of natural gas in the basement is believed to have ignited. The force of the explosion ruptured the reinforced concrete (hollow tile filler) first floor and caused it to fall into the basement, buckled up the second and third floors, completely demolished a concrete loading dock, and blew off elevator doors on all floors and the penthouse roof to the elevator. The blast was so powerful that cracks developed in the 12½-inch-thick reinforced concrete basement walls. Property damage was approximately $500,000.

Acme

An office on the second floor of the Sioux City, Iowa, meat packing plant at which a gas explosion occurred December 14, 1949.



This 5-story department store in Pontiac, Michigan, was originally three stories high of fire-resistive construction. Two upper stories were added with protected steel columns, non-combustible floor construction, and a combustible roof. On November 16, 1942, fire in a fifth-floor storeroom was discovered by an outsider at 3:02 A.M. Twenty minutes after the first hose stream was placed in service the roof, fourth and fifth floors collapsed. The fifth floor front wall and burning stock fell into the street and into the basement through light wells, setting fire to contents in the basement and first floor. There was no fire damage in the second and third floors. Building loss was $185,000 and contents loss $275,000.

Press Association

The contents of the fifth floor of this 9-story fire-resistive department store in Baltimore were destroyed and the building received considerable damage in an incendiary (arson) fire on February 24, 1947. Sprinklers were rendered useless by a closed valve. The protected structural steel framing on the five floors was undamaged, but heat and water destroyed the plaster on walls, columns and beams. Enclosed stair and elevator shafts prevented vertical spread, but the 1,000,000 gallons of water used in extinguishment ran down stairs and elevator shafts and across a bridge to the Annex. A considerable volume seeped through the floor construction (8-inch hollow tile filler topped with 3 inches of concrete). All ceilings from the basement through the fifth floor required replacement. Property damage was $1,670,000.

fifth floors collapsed. The fifth floor front wall and burning stock fell into the street and into the basement through light wells, setting fire to contents in the basement and first floor. There was no fire damage in the second and third floors. Building loss was $185,000 and contents loss $275,000.

William Kensit

The three upper floors of this unsprinklered 6-story building in Edmonton, Alberta, suffered considerable structural damage and the contents were destroyed by fire on March 8, 1949. The fire, which burned over a 36-hour period, had been developing for several hours in the premises of a wholesale dry goods company on the fourth floor before discovery by an outsider, and eventually reached the floors above through openings around pipes. Forty-two reinforced concrete mushroom type columns on each of the three 20,250 sq. ft. upper floors were spalled, the 8-inch-thick reinforced concrete floor slabs were cracked and sagged, and exterior brick walls were cracked. Loss $1,176,000.

Fire in the unsprinklered air-conditioning room on the top floor of the 5-story section of a modern fire-resistive hotel building in Cincinnati, January 21, 1942, was extinguished with little spread from the immediate area of origin, but smoke and water caused extensive damage to the 28-story building and its contents. Water bulged the ceiling of the ornate Hall of Mirrors, came through the ceiling of the hotel's night club; carpets and parqueted flooring were soaked and water cascaded down the broad stairs to the mezzanine, main lobby and lounge, and into basement storerooms. Smoke poured from the air-conditioning room as a result of the burning cork and mastic and permeated to many parts of the building through air ducts and windows overlooking the fire.

Air-conditioning room of Cincinnati hotel (above), where fire occurred on Jan. 21, 1942.

Chicago Tribune

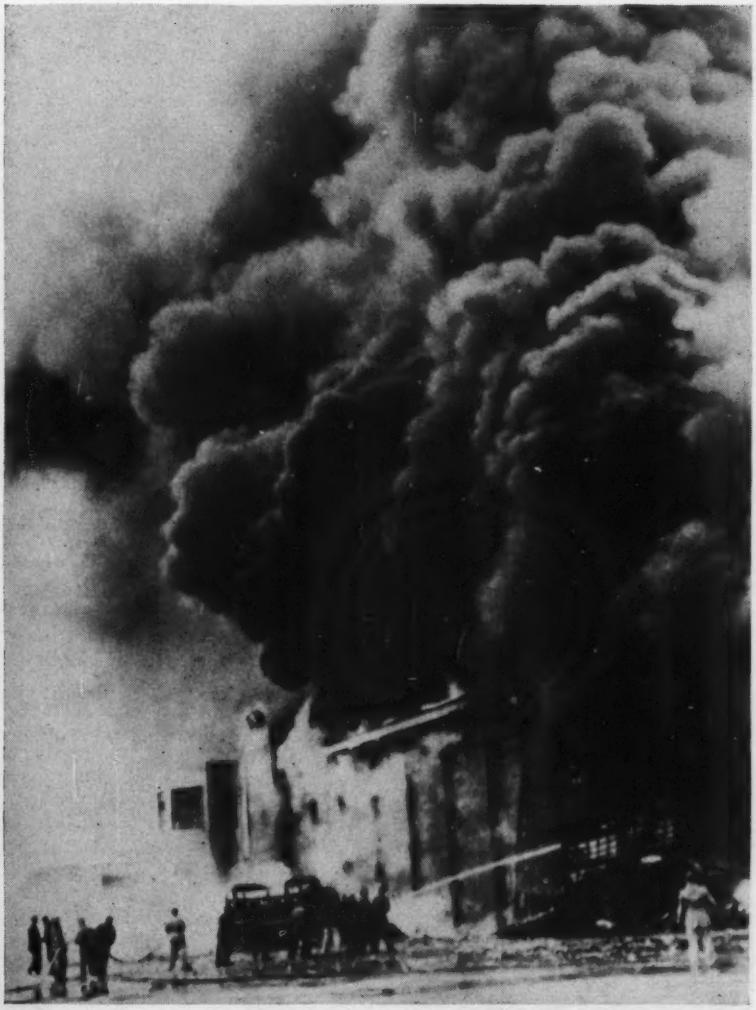
During the night of June 5, 1946, 61 guests and employees lost their lives in fire that originated on the first floor of the LaSalle Hotel in Chicago. Because of its protected steel-frame and reinforced concrete construction this building is correctly described as fire resistive. There were, however, certain other construction features: veneer panelling in the lobby and mezzanine floor, combustible interior finish in the cocktail room and coffee shop, unprotected concealed spaces and open stairways which permitted development of the fire and the resultant loss of life.

Press Association

The 15-story Winecoff Hotel at Atlanta, erroneously described as "fireproof," was the scene of fire, December 7, 1946, that took 119 lives and injured 90. Structurally, the fire resistance provided for the steel-framed building was sufficient to resist this fire without collapse. But the construction was certainly not proof against a disastrous fire. The single open stairway and corridors, wood doors and open transoms on guest rooms, combustible furnishings, painted burlap on partitions in the corridors and halls, wood interior trim and lack of automatic protection were some of the factors influencing spread of fire from floor to floor.

Acme

Four hundred and ninety-two persons lost their lives at the Cocoanut Grove night club in Boston, November 28, 1942, because of inadequate exits, combustible wall and ceiling finish and flammable decorations. It is often overlooked that with the exception of one addition, the building that housed the death trap was of one-story reinforced concrete construction.



Acme

A plane taking off from Wright Field, Dayton, Ohio, on March 6, 1945, crashed into a reinforced concrete modification hangar. Eight men were killed (3 in hangar) and nine injured. The plane struck through partially open steel hangar doors, immediately bursting into flame and involving two other planes in the hangar. An explosion resulted and gasoline from the three planes caused a general fire in the unsprinklered concrete hangar, involving six other planes. Cinder block walls separating the repair bays of the hangar prevented extension of the fire outside the bay of origin. The fire-resistive structural elements received only very minor damage despite the intense heat from the burning gasoline released from full fuel tanks of the aircraft. Slight structural damage, $3,000,000 damage to contents.

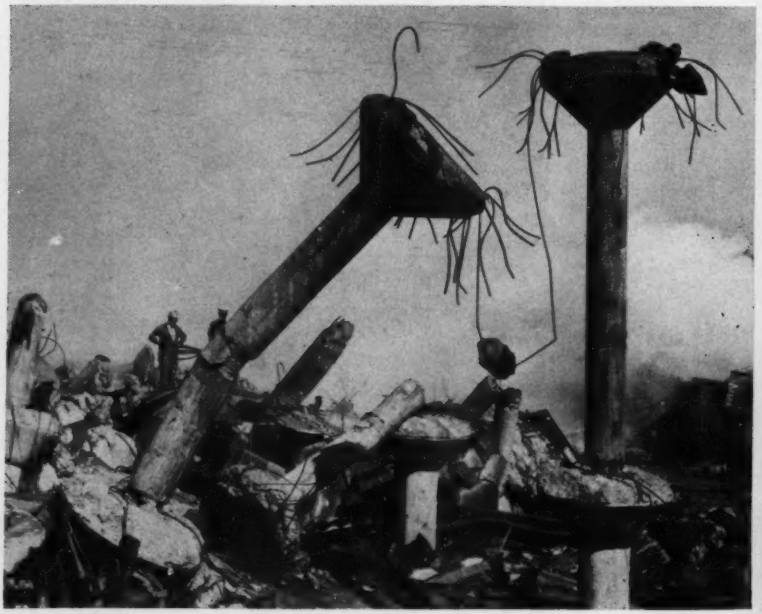
Acme

Four hundred and ninety-two persons lost their lives at the Cocoanut Grove night club in Boston, November 28, 1942, because of inadequate exits, combustible wall and ceiling finish and flammable decorations. It is often overlooked that with the exception of one addition, the building that housed the death trap was of protected reinforced concrete construction.

Los Angeles Fire Department

In the Texas City disaster, April 16-17, 1947, two fire-resistive pier warehouses were for the most part reduced to rubble when the S.S. *High Flyer* exploded. The ship was in the slip between the two piers. The picture at top shows the remains of Pier A and the 155-ft. by 880-ft. 2-story reinforced concrete pier warehouse.

Lower picture shows damage to warehouse B, a 2-story reinforced concrete pier structure 20 ft. wide and 1160 ft. long. At left is a view of reinforced concrete column failure. Part of this building, not shown here, remained upright. It should be noted that most of the destruction was explosion damage.



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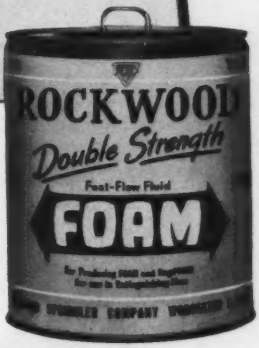

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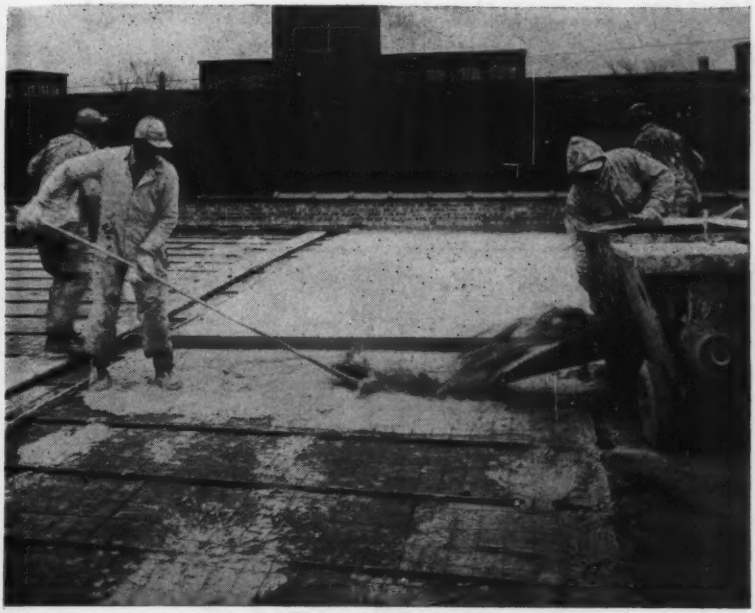


NONCOMBUSTIBLE

OWENS-CORNING FIBERGLAS **INSULATING FORM BOARD**

for Fire-Safe Gypsum and Concrete Roofs

Made of ageless fibers of glass, Fiberglas* Form Board will not burn or support combustion.

Weighing but .87 lb. per square foot, this board imposes negligible dead weight on the structure. It has excellent thermal and noise reduction characteristics. It can be spray-painted without alteration of its properties. Applied only by authorized contractors, Fiberglas Form Board is a practical roof material of enduring fire safety.

OWENS-CORNING FIBERGLAS CORPORATION

Dept. 117-G **Toledo 1, Ohio**

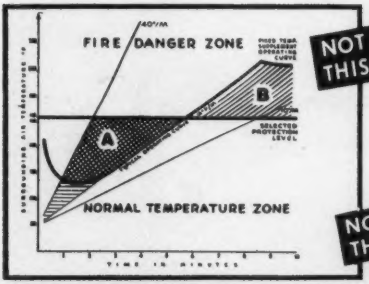
FIBERGLAS IS IN YOUR LIFE...FOR GOOD!

*Fiberglas is the trademark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

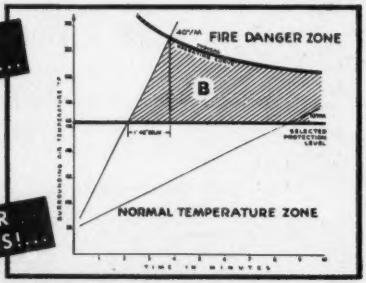
When seconds may mean lives!...

DETECT-A-FIRE... *Fastest-Acting, Most Fully Protective Device In The Field, Warns You In Time!*

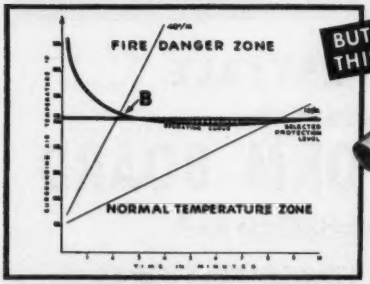
DETECT-A-FIRE operates on the exclusive Fenwal principle. Activating element is the *single-metal*, temperature-sensitive shell which, in direct contact with the air, reacts without lag. Approved by Factory Mutual Laboratories, listed by Underwriters' Laboratories, Inc., for ordinary and hazardous locations Class I, Groups C and D; Class II, Groups E, F and G for 25' spacing.



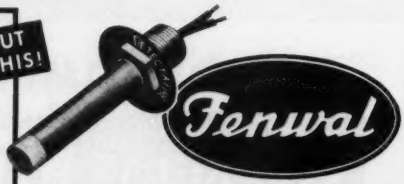
RATE-OF-RISE DETECTOR has dangerous false alarm zone (a), and unprotected zone (b), even with fixed-temperature supplement.



FIXED-TEMPERATURE DETECTOR permits wide unprotected zone (b), due to thermal lag.



DETECT-A-FIRE'S instant response leaves only negligible unprotected zone (b), eliminates false-alarming.



DETECT-A-FIRE

Combines Fixed-Temperature Response with Rate-Of-Rise Compensation for Instant Alarm

SENSITIVE... *but only to heat*

FREE bulletin gives you complete details on amazing Detect-A-Fire. See how you, too, can improve your fire alarm and extinguishing systems. Just mail coupon.

NAME.....POSITION.....

COMPANY.....

STREET.....

CITY..... ZONE.....STATE.....

FENWAL INCORPORATED, 147 Pleasant Street, Ashland, Massachusetts
Temperature Control Engineers

Eyes RIGHT for your RIGHT Pyrenes!

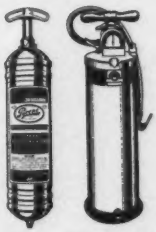
Buy them the reliable, prompt, economical, easy way—from your local Pyrene jobber

Call on your local Pyrene* jobber for the right Pyrenes for your hazards. Pyrene makes extinguishers for *every* fire hazard; jobbers carry various types in stock. That means you get immediate delivery, pay no freight charges from the factory, and deal with an established local business. It pays you to *standardize* on Pyrene—for precision workmanship, real dependability, greatest dollar value. Write for name of your local Pyrene jobber.

*T.M. Reg. U.S. Pat. Off.

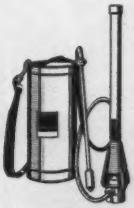
CARTRIDGE-OPERATED

New stainless steel shell . . . new low price. No annual recharging; no acid dangers. For fires in wood, paper, textiles. 2½ gal size.



VAPORIZING LIQUID

The all-purpose extinguisher effective on almost every kind of fire. Safe on electrical fires, too. 1 qt. and 1½ qt. pump types; 2 qt. and 1 gal. pressure-operated types.



AIR FOAM

Couple playpipe to hose line. Every 19 gals. of water and 1 gal. of PYRENE Foam Compound yield 350 gals. of foam! For flammable liquids and ordinary combustibles.

PYRENE MANUFACTURING COMPANY

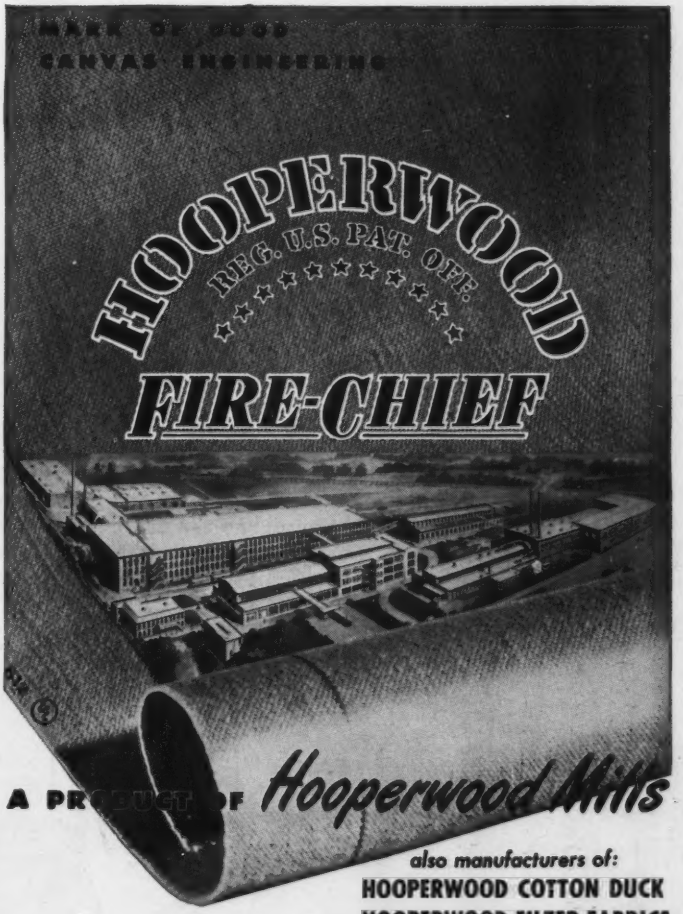
582 Belmont Avenue Newark 8, New Jersey

Affiliated with C-O-Two Fire Equipment Co.

ALSO CHEMICAL FOAM, SODA-ACID, PUMP TANK AND OTHER EXTINGUISHERS; MANUAL AND AUTOMATIC SYSTEMS

CUT OPERATING EXPENSE WITH DEPENDABLE PROTECTION

GLOBE
SPRINKLERS
FIREMEN EVERY 10 FEET
Most Fires are Night Fires. Statistics show that most FIRES occur when help is away ... a fact that emphasizes the need for GLOBE Sprinkler protection. GLOBE Sprinklers are always on duty ... always ready for action.
GLOBE AUTOMATIC SPRINKLER CO.
NEW YORK ... CHICAGO ... PHILADELPHIA
Offices in nearly all principal cities
THEY PAY FOR THEMSELVES



A PRODUCT OF *Hooperwood Mills*

also manufacturers of:

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HOOPERWOOD FILTER FABRICS
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IMPERIAL ROPE
STERLING SASH CORD
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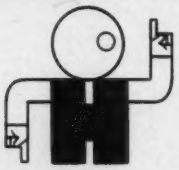
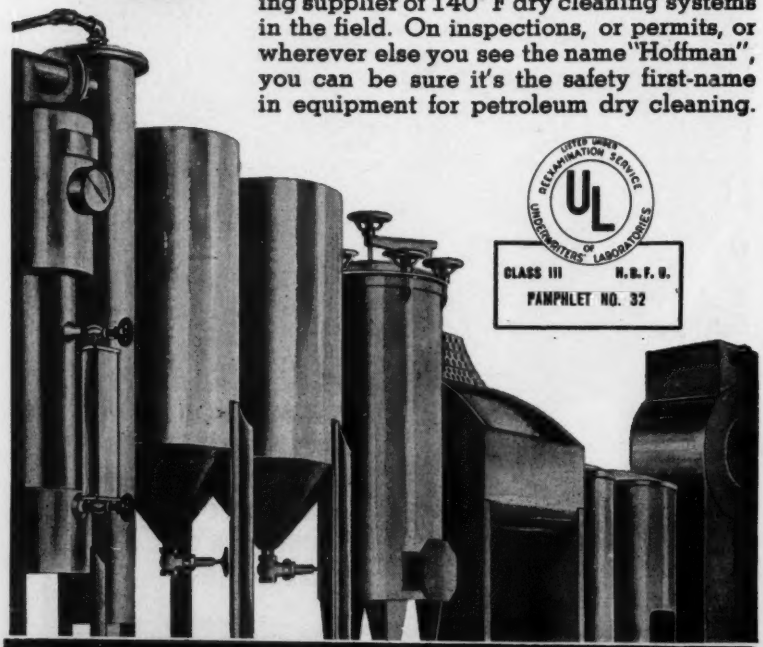
PROVED by a 14-Year CLEAR LOSS RECORD

HOFFMAN 140-F UNITS FOR SAFE DRY CLEANING



Year after year, the safety of commercial dry cleaning with 140° flash-point, petroleum solvent has been proved by Hoffman equipment. Hoffman originated the process in 1935 and, ever since, has been the leading supplier of 140° F dry cleaning systems in the field. On inspections, or permits, or wherever else you see the name "Hoffman", you can be sure it's the safety first-name in equipment for petroleum dry cleaning.



U. S. HOFFMAN MACHINERY CORPORATION
105 Fourth Ave., New York 3, N.Y.
DRY CLEANING, LAUNDRY & GARMENT PRESSING EQUIPMENT

Your Best Protection

FOR FLAMMABLE LIQUID, GAS AND ELECTRICAL FIRES

GASOLINE · OIL · LP-GAS · NAPTHA
BENZENE · ALCOHOL · LACQUER
VARNISH · SOLVENTS · PAINTS, ETC.

ANSUL
DRY CHEMICAL
FIRE EXTINGUISHERS

They're most dependable too! Years of field service on all kinds of industrial applications has resulted in outstanding design features available ONLY in Ansul Dry Chemical Extinguishers.

FIRE PROTECTION by the dry chemical method has proved *Most Effective* as well as *Most Economical*. And only Ansul offers a complete line of hand, wheeled and stationary dry chemical fire extinguishers. Investigate Ansul Piped Systems for protection of special hazards.

Send for File No. 513. You will receive a variety of helpful printed matter. Included is our latest catalog which describes Ansul Extinguishers of all sizes — from the small Ansul Model 4 to Ansul Piped Systems and Ansul 2000 lb. Stationary Units.

ADVANTAGES

1. Quick, Positive Extinguishing Action. 2. Easier on the Spot Recharge (No special tools needed). 3. No Annual Recharge Necessary. 4. Low Maintenance Costs. 5. ANSUL PLUS-FIFTY Dry Chemical used Exclusively. 6. Long Range Stream. 7. Effective in Winds and Drafts. 8. Stream pattern forms heat shielding screen to protect operator. 9. Listed and Approved by Underwriters' Laboratories, Inc., and Factory Mutual Laboratories.

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN
DISTRIBUTORS IN PRINCIPAL CITIES IN THE UNITED STATES, CANADA AND OTHER COUNTRIES

HIGH EFFICIENCY LOW MAINTENANCE

MH HYDRANTS and VALVES

EASY TO INSTALL MECHANICAL JOINT

Adjustable Indicator Post.

M & H Mechanical Joint Hydrants and Valves are furnished for use with standardized Mechanical Joint Cast Iron Pipe or with plain-end Bell and Spigot Pipe. The Joint has a triangular shaped stuffing box in which a gasket is compressed by bolting up a Cast Iron Ring or Gland with a ratchet wrench — the only tool required. Joint pouring is eliminated.

Features include: (1) Fast and easy installation, (2) unskilled labor, (3) construction economy, (4) joint deflection, (5) leak-tight. We furnish Standardized Mechanical Joint Valves, Hydrants and Cutting-in Sleeves. WRITE FOR CIRCULAR 49.

M & H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

WHAT do you "FILE and FORGET"

Important savings may be effected by the proper classification of business documents.

The authoritative National Fire Protection Association (NFPA) lists four separate types of documents: Class 1 (VITAL), Class 2 (IMPORTANT), Class 3 (USEFUL), and Class 4 (NON-ESSENTIAL).

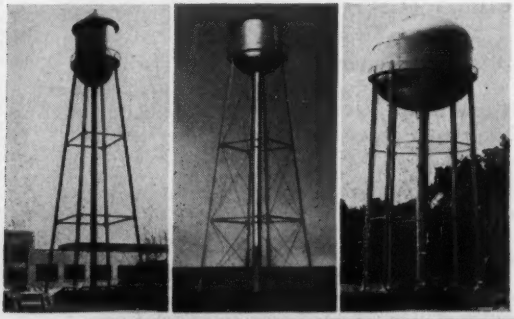
It's not necessary to store non-essential papers in a vault, safe, insulated container or insulated file—constructed for maximum protection under all conditions. Conversely, it is false and dangerous economy to house vital papers in a safe container designed only for limited protection.

Good management dictates an approach to the question of safe-equipment that offers *the soundest record-protection at the lowest cost.*

Your local safe-equipment representative will be more than happy to advise you on document classification, and on the safety-ratings of your present equipment. He's a good man to know. Consult him today.

SAFE MANUFACTURERS NATIONAL ASSOCIATION, Inc. 366 MADISON AVE., NEW YORK 17, N. Y.

PITTSBURGH • DES MOINES ***INDUSTRIAL***



Elevated Steel Tanks

Choose the Pittsburgh-Des Moines Elevated Steel Tank meeting your precise requirements in type and capacity, and you will enjoy every benefit of safe and certain water supply—at lower cost —*with guaranteed dependability*. Write for our latest "Modern Water Storage" Brochure.

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

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NEW YORK (7) . . Room 950, 270 Broadway
CHICAGO (3) . 1272 First National Bank Bldg.
SANTA CLARA, CAL. . . 675 Alviso Road
DES MOINES (8) . . . . . 969 Tuttle Street
DALLAS (1) . . . 1273 Praetorian Building
SEATTLE . . . . . 976 Lane Street

In The Background Till Fire Strikes

Fits in smoothly with the most modern interiors. Barely visible, but ready at a second's warning to spring into action. Viking Flush Type Sprinkler Heads offer great *dependability*, plus true functional design. Get all details today from the *Viking* representative in your neighborhood.

THE VIKING FLUSH TYPE SPRINKLER HEAD

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Seattle, Washington
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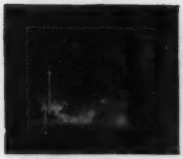
THE VIKING CORPORATION
HASTINGS, MICHIGAN

TESTS CONFIRM...

Test structures built of Koppers fire-retardant wood (left) and untreated wood (right) ready for the fire test. Five quarts of kerosene, placed in pans, furnishes fuel for each blaze.



Both structures are quickly enveloped in flame. Treated structure resists fire, but untreated one encourages it, contributes fuel to the fire.

After twenty-two minutes the untreated structure, still burning, is collapsing. Note that in the treated structure, the fire stopped when the fuel burned out.

KOPPERS

KOPPERS PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

PITTSBURGH 19, PA.

fire retardance of KOPPERS CZC(FR)

Koppers fire-retardant wood is suitable for use as flooring, roofing, sheathing and structural members of industrial buildings, garages, airplane hangars, munitions plants, docks and warehouse buildings, railroad engine houses, and other similar structures. Koppers CZC(FR) treatment has a valuable plus advantage, for it also fortifies the wood against decay and termite attack. Color and paintability are not harmed by the odorless CZC(FR) treatment.

Investigate the possibilities of this new Koppers development. Send for your copy of the booklet, "Koppers Fire-Retardant Wood." Filled with interesting, helpful information.

Right · The treated structure was charred . . . but retained its integrity and strength, as the 800 pound load shows.

Left · Continued burning reduced the untreated structure to ashes.

LET'S DO THE WHOLE JOB!

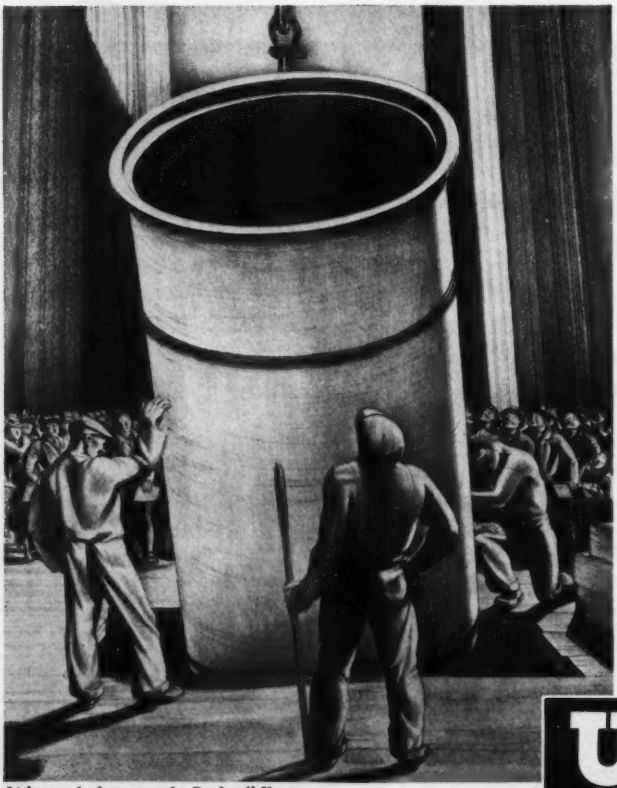
Any panic release hardware, as long as the price is low enough, may satisfy the man who is told to install it.

But, after all, panic devices are not put on doors just to please a public official; they are installed to protect the lives of the people in the building. Unless they are strong enough to operate under the tremendous demands of panic-driven crowds, they are utterly useless. Flimsy, sluggish devices can not, and will not, take this sort of punishment.

Von Duprin devices provide a safety factor far beyond the needs of emergency operation. They are quick in action, long wearing and trouble-free. They are, in short, the kind of devices every owner wants when fire or panic strikes.

VON DUPRIN DIVISION
VONNEGUT HARDWARE CO., INDIANAPOLIS 9, INDIANA

In Canada, write Yale & Towne Mfg. Co. (Canadian Div.), St. Catharines, Ont.



Lithographed on stone by Rockwell Kent

U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

"Meet the customers' needs" has been our watchword for more than fifty years. Whether it's pipe seven feet, or a few inches, in diameter — or a complicated fitting — or a special casting — we have the equipment and the technical skills to meet almost any need for cast iron pressure pipe and fittings. Taking advantage of process developments and utilizing scientific methods to control quality, our plants are regularly manufacturing products that adequately meet our customers' exacting requirements. United States Pipe and Foundry Company, General Offices: Burlington, N. J. Plants and Sales Offices Throughout U. S. A.

RELIABLE

AUTOMATIC SPRINKLER DEVICES

PROTECTING LIFE AND PROPERTY FOR OVER 25 YEARS

Reliable Automatic Sprinkler Devices have an excellent field record . . . superb in design and construction . . . are universally approved by all Fire Insurance and Governmental Authorities . . . and effect maximum reductions in fire insurance premiums.

They comprise a complete line including Automatic and Open Sprinklers, Alarm Valves, Dry Pipe Valves, Accelerators, Circuit Closers, Water Motors and all other accessories required in Sprinkler Systems.

Reliable Systems are protecting thousands of properties throughout the United States, Canada and foreign countries.

FURTHER INFORMATION UPON REQUEST

Manufactured and Distributed by

The Reliable Automatic Sprinkler Co. Inc.

BRONX STREET MOUNT VERNON, N. Y.

"Eternal Vigilance"

—THE PRICE OF SECURITY!

WHETHER IT BE NATIONAL OR INDIVIDUAL PERFORMANCE . . . SECURITY IS ACHIEVED ONLY BY THE EVER-ALERT, EVER-CAPABLE AND EVER-DEPENDABLE!

All of these requisites for SECURITY against loss of life and property by fire are provided through the "ETERNAL VIGILANCE" of

STAR AUTOMATIC SPRINKLERS

Automatic Sprinklers
Corrosion-Proof Sprinklers
Directional Flow Sprinklers
Open Sprinklers
Spray Sprinklers
Alarm Devices

Automatic Releases
Standard Wet Pipe Systems
Dry Pipe Systems
Deluge Systems
Heat-Actuated Devices
Pre-Action Systems

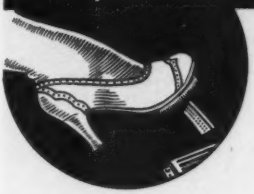
Star Automatic Sprinklers and Fire Protection Devices bear approval of all Insurance Authorities having jurisdiction and various Governmental Agencies.

Economy in installation cost and maintenance has dictated the consistent policy of Star Sprinkler Corporation in distributing its Fire Protection Devices through local licensed contractors who have had a lifetime of experience in the installation of automatic sprinkler systems. Operating throughout the United States, Canada and South America, Star licensees, due to their strategic locations, can render instant service. Write us for name and address of Star licensed contractor nearest your location.

STAR SPRINKLER CORP.

Westmoreland and Collins Sts. — Philadelphia, Pa.

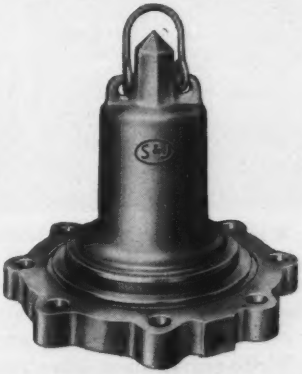
Experience Has Proved Hydraulic Power Best



S. & J. Hydraulic Valve Operator.

When her "number 4s" nudge hydraulic brakes, her car can squeak to a quick, safe stop. Auto manufacturers have learned from years of experience that hydraulic power is the best means of transmitting force evenly from one point to another. Hydraulic power exerts pressure positively —or not at all. Constant, even pressure must be maintained to make automotive brake systems operate smoothly.

Shand & Jurs have engineered the same safe and dependable hydraulic principles into their Hydraulic Internal Safety Valve System for truck tanks. They insist on supplying the safest and most dependable petroleum tank safety valves available. Pictured at the upper right is the light weight, ruggedly built valve operator, which is actually an hydraulic pump. At the lower right is the Hydraulic Internal Safety Valve which is kept closed by spring pressure. It can be opened only by hydraulic power supplied by two or more strokes of the valve operator handle. As soon as pressure is released all open valves automatically close. For maximum safety and dependability, choose S. & J. Hydraulic Internal Safety Valve Systems for your petroleum truck tanks.



S. & J. Hydraulic Internal Safety Valve.

SHAND & JURS CO.

BERKELEY, CALIFORNIA

NEW YORK CHICAGO HOUSTON LOS ANGELES SEATTLE

SHAND & JURS

Insurance Savings Pay for Tank

When Fibreboard Products, Inc. built their new plant near Antioch, Calif., they installed the 100,000-gal. elevated tank shown above to provide the primary water supply for the automatic sprinkler system. The new tank aided in obtaining a Superior Risk Classification and it is estimated the tank will pay for itself in about five years.

Write our nearest office for quotations on tank installations. State capacity, height to bottom and location.

CHICAGO BRIDGE & IRON COMPANY

CLEVELAND	CHICAGO	BIRMINGHAM	NEW YORK
HAVANA	DETROIT	ATLANTA	PHILADELPHIA
HOUSTON	TULSA	LOS ANGELES	SAN FRANCISCO
CARACAS	BOSTON	SEATTLE	SALT LAKE CITY

Plants at Chicago, Birmingham, Salt Lake City and Greenville, Pa.

with no capital investment involved!

Deluge Systems, Wet Pipe Systems, Dry Pipe Systems, Water Spray and Fog Systems, Rate-of-Rise Sprinkler Systems, and Foam and Carbon Dioxide Extinguisher Systems.

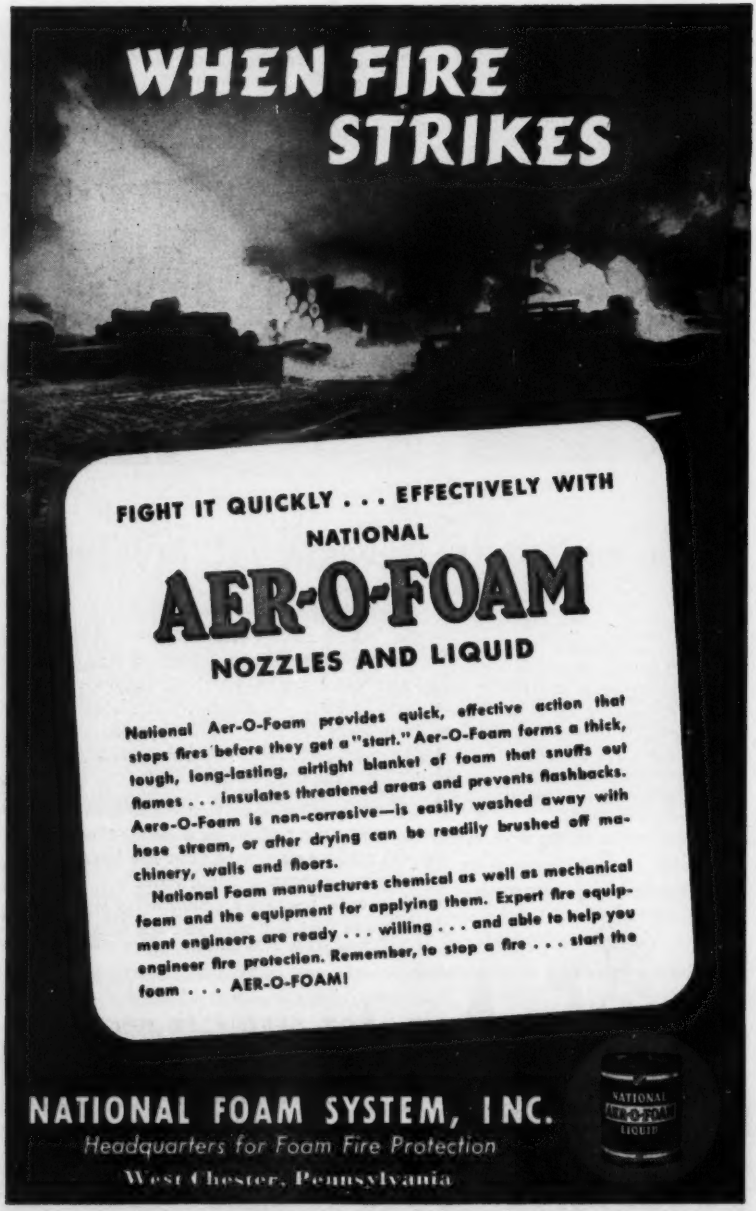
YOUR yearly insurance savings applied to the cost of a Blaw-Knox Fire Protection System converts an existing expense into a capital asset. Reductions from 50 to 90% are effected when lives and property are safeguarded by this fully recognized fire protection—quickly amortizing the entire cost.

At your request a Blaw-Knox Engineer will come to your office for consultation. He will make a survey of your fire hazards, secure your insurance underwriter's requirements, prepare a preliminary layout of a system that will give you the utmost in fire protection, and submit an estimate of costs—all without obligation.

"LITT
JOEY SP

LAW-KNOX SPRINKLER DIVISION
BLAW-KNOX CONSTRUCTION COMP
82 ver Ave., N Pittsburgh 12, Pa.
Offices in Cities

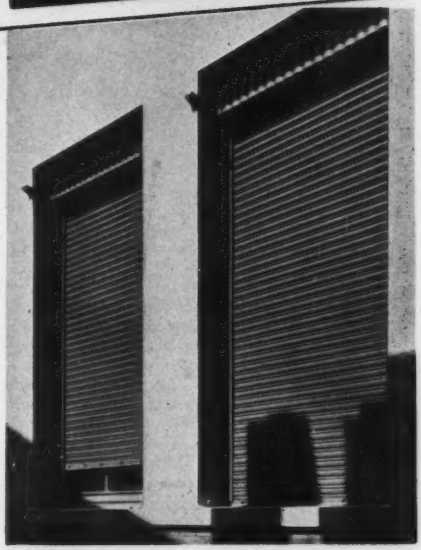
BLAW-KNOX
PROTECTION
SYSTEMS


WHEN FIRE STRIKES
FIGHT IT QUICKLY . . . EFFECTIVELY WITH
NATIONAL
AER-O-FOAM
NOZZLES AND LIQUID
National Aer-O-Foam provides quick, effective action that stops fires before they get a "start." Aer-O-Foam forms a thick, tough, long-lasting, airtight blanket of foam that snuffs out flames . . . insulates threatened areas and prevents flashbacks. Aero-O-Foam is non-corrosive—is easily washed away with hose stream, or after drying can be readily brushed off machinery, walls and floors.
National Foam manufactures chemical as well as mechanical foam and the equipment for applying them. Expert fire equipment engineers are ready . . . willing . . . and able to help you engineer fire protection. Remember, to stop a fire . . . start the foam . . . AER-O-FOAM!
NATIONAL FOAM SYSTEM, INC.
Headquarters for Foam Fire Protection
West Chester, Pennsylvania
NATIONAL
AER-O-FOAM
LIQUID

LACK OF EFFECTIVE FIRE DOORS IS MAJOR CAUSE of EXCESSIVE FIRE LOSS

40% of major fires in 1946 showed lack of fire-door protection as contributing to loss*

Guard all openings with KINNEAR STEEL ROLLING FIRE DOORS and SHUTTERS



You get *positive, automatic, dependable* fire protection at doorways, windows and other horizontal openings with the famous Akbar Fire Doors. They're *pushed* downward by a strong spring . . . *controlled* in downward speed by a special safety device . . . and operable *after* automatic closure, for emergency use. These efficient doors remain coiled out of the way overhead when not in use, but lower into place with speed and efficiency when fire threatens. They combat fire loss by cutting off drafts, blocking the spread of flames, and confining fire to small areas. Approved and labeled by Underwriters' Laboratories, they have saved as much as 33% of their cost *annually*, in reduced insurance rates. Built to fit windows, doorways or other openings of any size. Write for complete information.

Kinnear Rolling Fire Doors can also be equipped for daily service use, with or without motor operation. But the regular (non-labeled) Kinnear Rolling Doors are preferred for service use where extra fire protection is not required.

**In one year, out of 187 fires involving losses of $250,000 or more, 77 showed lack of protection at doorways as a contributing factor (as reported in the January 1947 Quarterly of the National Fire Protection Association).*

KINNEAR ROLLING DOORS — SAVING WAYS in DOORWAYS

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